39224

LORAL
INSTRUMENTATION

SBA
FAMILIARIZATION PACKAGE

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INTRODUCTION TO THE FAMILIARIZATION PACKAGE

This package was developed to help introduce the SBA to the user. The goal of this package is to provide the user the needed knowledge to perform the correct SBA operation to monitor or test a 1553 bus system. The three parts of this package are:

FAMILIARIZATION GUIDE (FAM GUIDE)

This guide gives a detailed review of SBA operations, covering all SBA "pages" variables and setups. The guide is divided into modules according to usage, and each module may be reviewed independently.

FAMILIARIZATION DISK

This disk gives further insight to SBA "pages" and variables and how these pages and variables affect the 1553 bus under test and related SBA operations. The disk follows the same pattern as the FAM GUIDE and it is recommended that the user follow along on the disk while reading the guide.

SBA EXERCISES

These exercises (tasks) are given to test the user's knowledge of the SBA. There are three tasks ranging from very easy to fairly complex operations. The solutions to the tasks are also given along with the correct SBA "page" displays. These exercises require no external equipment support.

Questions or Comments

If there are any questions or comments regarding this package or any SBA operation, feel free to call an Application Engineer at:

1-800-541-0419
(in California 619-560-5686 x4520)

DISK GUIDE

The Familiarization Disk contains 19 files and each of those files have about 5 text pages. A directory of the disk may be displayed by entering DDX (carriage return) where DD represents DISPLAY DIRECTORY and X represents the drive number (0 for the top drive and 1 for the bottom drive). The following instructions will help in the operations of the Familiarization Disk.

Any file may be loaded for viewing by entering L"XXXXXXXXXXXXX" (carriage return) where L represents LOAD FROM and X represents the file name. The beginning and ending double quotes must be entered. The front panel keys listed below will enable successful viewing of the text.

KEY 1 - Continues text viewing from page to page.

KEY 2 - STARTS or restarts file displays. If the user enters an SBA page during the viewing of the text, this key must be pressed to continue the displays. Some pages may be repeated when this key is used to restart a file display sequence.

KEY 4 - This key must be pressed when an SBA operational example has been executed or displayed. For example, if a Stack display has been shown, then KEY 4 would be pressed to continue text viewing.

A few helpful hints follow:

1. If for some reason the SBA stops the programed display sequence, press the RESET key on the front panel and then press KEY 2 to restart the display sequence.

2. When finished viewing a dynamic example (Terminal page, Stack page, etc), press the HALT key to clear the activity.

IF THERE ARE ANY QUESTIONS ON THE OPERATION OF THE DISK, OR DURING ANY SBA OPERATION CALL AN APPLICATION ENGINEER AT LORAL.

1-800-541-0419
IN CALIF. 619-560-5888 X4520

FOR SBA REPAIRS CALL A FIELD SERVICE ENGINEER AT:

1-800-854-1036
IN CALIF. 619-560-5888 X4520

TEXT FORMATTING

In order to have a clear and uniform text, system commands are contained in set enclosers: ' ', [ ], < >.

Single quotations ' ' - Characters within these enclosers are for the typewriter style keyboard.

Brackets [ ] - Characters within these enclosers are for the keypad on the right-hand side of the keyboard. Keypad entries are omitted if they are the same as regular keyboard, and some system commands can not be entered from the keypad.

Greater-than, Less-than < > - Characters within these enclosers represent system default values.

All commands are executed by pressing the 'RETURN key or the **CR** key on the front keypad of the unit.

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Operator's Table of Contents

Use this page to list locations for specific usages.

TAPE TEXT GUIDE Module.Page	Content

Procedure to Set Up and Display Specific Function Results

1. Decide what function is to be performed by the SBA.

2. Access the applicable page(s) and make any necessary entries.

3. Access the Command Line and key-in the appropriate command to initiate the desired function.

4. Access the appropriate page to display the results.

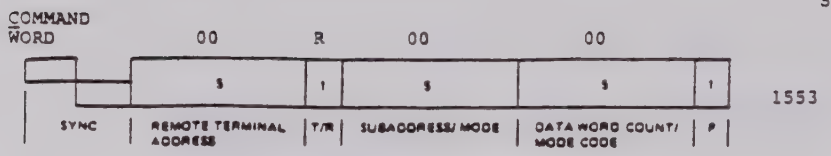
FUNCTION	SET-UP PAGE(S)	DISPLAY PAGE(S)
Background Activity Monitoring	Oper Mode 1 Oper Mode 2 Priority Page	Display Terminal Display Terminal Activity Display Terminal Error
Selective Activity Monitoring	Oper Mode 1 Oper Mode 2 Priority Page Capture Page	Stack
Remote Terminal Simulation	Oper Mode 1 Oper Mode 2 1-32 RT Pages	(See Monitoring)
Bus Controller Simulation	Oper Mode 1 Oper Mode 2 1-32 BC Pages Frame Format Page	(See Monitoring)
Noise Testing	Oper Mode 1 BC Page 01 Frame Format Page	Noise Test Page
Automatic Testing	1-254 Keyrecord Pages	(As appropriate)
Host Interfacing	I/O Set Up Page	(As appropriate)

SBA HEX WORD FORMAT vs.1553

BIT TIMES

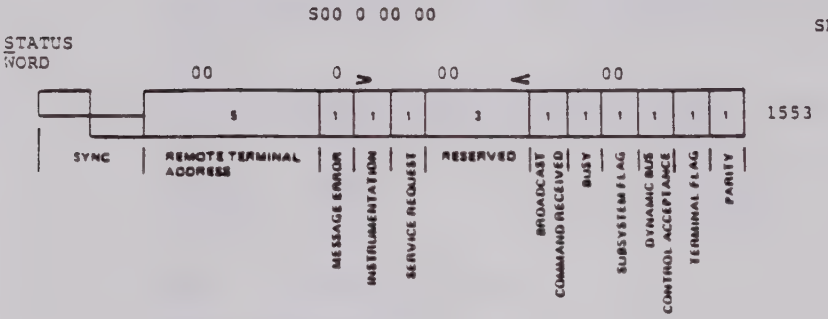
C00 R 00 00

SBA



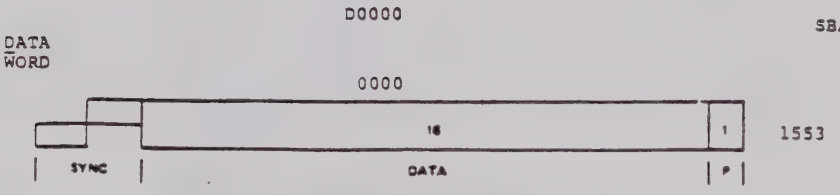
S00 0 00 00

SBA

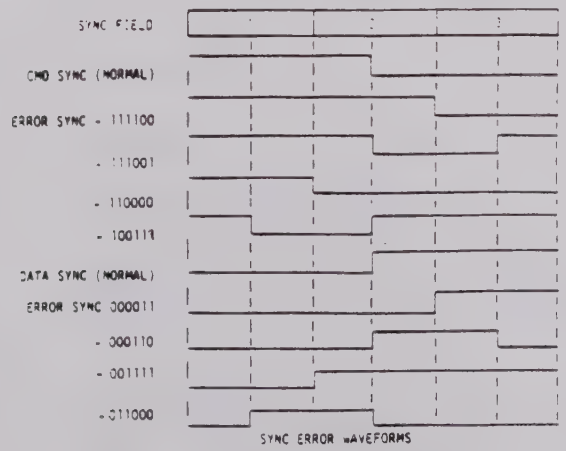


D0000

SBA



PARITY IS NOT INCLUDED IN SBA WORDS.



SYNC ERROR WAVEFORMS

Warning Message List

The following warning messages will appear on the CRT due to the causes listed below:

Warning Message	Cause
WARNING! REINITIALIZES SYSTEM	TEST SYSTEM command entered
INCOMPLETE ENTRY	Entry not fully completed before execution
INVALID ENTRY	Gap Time or Minor Frame Time of 0000 entered, or attempt to enter a Data Buffer starting address over 0667.
PRIORITY SETUP ERROR	Duplicate and omitted errors listed on Priority Page.
PRINTER OFF LINE	Save Command directed to LPT without having LPT connected to SBA.
HOST DISCONNECT (flashing)	Save or Assign Command directed to RS232 port without having host connected to SBA.
NOT ALLOWED	Save GPIB, RS232, or Tape to LPT Commands entered.
TAPE	Control Assigned to Tape
RS-232 LOCK	Control Assigned to RS-232
GPIB LOCK	Control Assigned to GPIB
LOCK	Keyboard and keypad locked out with CTRL L Command.
VALUE NOT FOUND	Requested value not found in Stack.
STACK ADDRESS OUT OF RANGE	Improper Stack address requested
ADDRESS OUT OF RANGE	Data Buffer Address above 0799
ENTRY OVER 65535	Decimal entry above 65535
X ILLEGAL IN DECIMAL BASE	Attempt to enter X's (don't cares) in decimal base.
RESPONSE ERROR: INVALID ON BC PAGE	Attempt made to enter response time error on BC page.
ILLEGAL FRAME SEQUENCE	Double-dash (- -) entered after last BC page number on Frame Format page.
FILE NOT READY	Position Tape at (X), or Save to Tape entered with no tape cartridge in place.

Module 1. SBA Introduction

This module is an introduction to the features of the SBA.

Rear Panel Connections

The SBA has five external information ports: Keyboard, RS-232c, IEEE-488 (GPIB), Line Printer, High Speed Parallel, and Composite Video (the last two are not available on all models).

Keyboard

The Keyboard interface is made with a 25-pin connector, pin-to-pin cable.

RS-232c and IEEE-488

The RS-232c and IEEE-488 data ports can be used not only to transfer information, but may also be assigned to run the SBA from an external device. (See module 7. and 9. for more information)

Line Printer

The Line Printer is a Centronix interface with a 25-pin connector. (See module 7. for pin-outs)

High Speed Parallel

This 24-bit parallel port constantly outputs passive 1553 bus monitor information.

Composite Video

This BNC port ouputs the SBA display video operating at 19.8 KHZ (horizontal frequency).

Front Panel LED's

The Front Panel LED's provide an at-a-glance display of the 1553 bus status. The following table describes the order, label, and function.

LED	COLOR	ACTIVITY
PWR	GREEN	SBA SYSTEM ON
SYNC	YELLOW	SYNCHRONIZED BUS
ACTY	YELLOW	ACTIVITY ON THE BUS
XMIT	YELLOW	SBA IN TRANSMIT MODE
ERR	RED	BUS ERROR INDICATOR

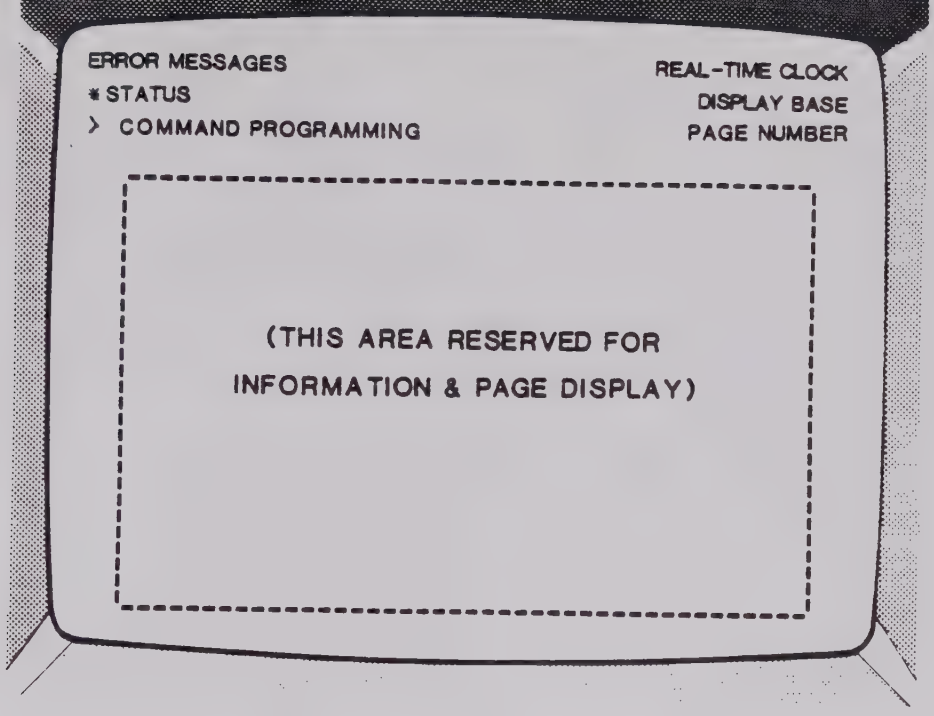
Front Panel

The Front Panel Keypad has 20 hex entry keys and 12 special function keys. The special function keys consist of:

KEYS 1-4	EXECUTE KEYRECORD 1-4
XMIT	CAUSES BC TRANSMISSION FOREVER
INCR	INCREMENTS INPUT VALUES OR LINES
DECR	DECREMENTS INPUT VALUES OR LINES
HALT	STOPS BC TRANSMISSION
ON/OFF	TURNS SBA ON/OFF
LOAD TAPE	LOADS TAPE FILE
EJECT	REWINDS AND EJECTS THE TAPE
RESET	RESETS SBA ACTIVITY

CRT OPERATIONS

The Cathode Ray Tube (CRT) is a nine inch monochrome green phospher (P31) display. The top three lines display system information. The top-most line (1 in the figure below) displays system errors and the programable clock (see module 9. for setting the clock). The second line (2) displays the Trigger status (see module 3. for Trigger information), and current operator-selected display base: i.e. BIN for binary, HEX for hexidecimal, and DEC for decimal. The third line, referred to as the "Command Line," displays the command entry and the number of the page being displayed (1-13; see table below).



AN EXAMPLE OF A CRT DISPLAY

PAGE NUMBER	PAGE MENU NAME
00	OPERATION MODE 01 PAGE
01	OPERATION MODE 02 PAGE
BC ##	BUS CONTROLLER AND PAGE NUMBER
RT ##	REMOTE TERMINAL AND PAGE NUMBER
05	I/O PAGE
KEY ###	KEYRECORD AND PAGE NUMBER
07	TERMINAL PAGE
08	TERMINAL ACTIVITY OR TERMINAL ERROR PAGE
09	NOISE TEST PAGE
10	FRAME FORMAT PAGE
11	MEMORY DISPLAY PAGE
12	STACK PAGE
13	PRIORITY PAGE

MENU PAGE AREA EXPLANATION

Cursor Controls

There are four arrows on the keyboard and only three on the keypad which are used to move the cursor.

THIS KEY MOVES THE CURSOR DOWN ONE POSITION, OR RETURNS THE CURSOR TO THE COMMAND LINE WHEN PRESSED FROM THE BOTTOM OF A PAGE.

THIS KEY MOVES THE CURSOR TO THE RIGHT ONE POSITION.

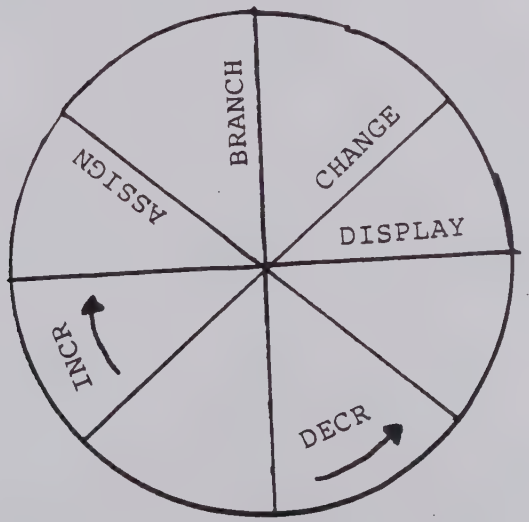
THIS KEY MOVES THE CURSOR TO THE LEFT ONE POSITION.

THIS KEY RETURNS THE CURSOR TO THE COMMAND LINE.

THESE KEYS DELETE AN ENTRY TO THE LEFT OF THE CURSOR POSITION.

Software Wheel

All entries for the SBA are contained within tables or "wheels." Command and in-page values can be entered by the exact key entries or may be obtained by using the INCREMENT (**INCR**) or DECREMENT (**DECR**) keys to scroll the software wheel for the desired entry.



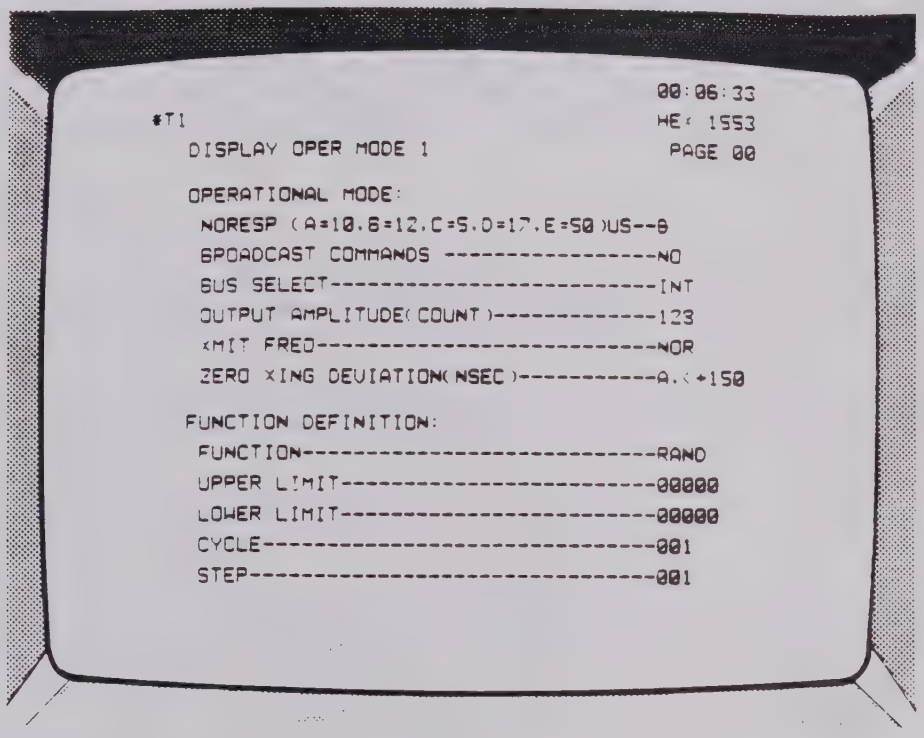
AN EXAMPLE OF A SOFTWARE WHEEL WITH SBA COMMANDS

NOTE: ONCE A DESIRED ENTRY IS FOUND, MOVE THE CURSOR TO THE RIGHT BEFORE EXECUTING. THE COMMAND "DISPLAY STACK VALUE" IS NOT INCLUDED IN THE SOFTWARE WHEEL.

MODULE 2 INITIAL SETUP

Operation Mode 01 Programing

The Operation Mode 01 page defines the 1553 electrical configuration for the SBA and must always be programed for correct operation of the SBA in any mode. The following is a line-by-line, top-to-bottom guide for programing the Operation Mode 01 Page.



TO DISPLAY THIS PAGE ENTER '**DO1**' [DO].

Setting the Maximum Response Time.

The Maximum Response time is the time period allowed by the BC for a response from a valid command word. There are five response times. Choose the letter corresponding to the desired time.

'A' = 10 uSEC
'B' = 12 uSEC
'C' = 05 uSEC
'D' = 17 uSEC
'E' = 50 uSEC

The variables D and E are not standard 1553 response times and can be used to test standard, or nonstandard 1553 systems. It is possible to enter any desired time with a GOSUB program (see Appendix B). <Default =B>

Broadcast Commands

This variable is for selecting the Broadcast Command option. If the Broadcast Command is desired for the bus system connected, enter 'Y' [1] for YES; the SBA will NOT assign a "NO RESPONSE" error after a Broadcast Command is sent. If the Broadcast Command option is not desired, enter 'N' [0] for NO; the SBA WILL assign a "NO RESPONSE" error if a response is NOT detected. <Default =0>

Output Amplitude

This variable defines the waveform output amplitude of the SBA. The operator may enter an integer from 0 to 255 to configure SBA output. The following procedure may help set this variable.

1. To find the precise voltage, connect an oscilloscope to the appropriate location on the bus system (with a 70 ohm load).

2. With the SBA transmitting, measure the amplitude of the SBA's signal.

3. Enter a higher or lower number count on the Operation Mode 1 Page and compare the reading to the desired amplitude. Repeat this step until the desired amplitude is obtained.

Transmit Frequency (XMIT).

This variable sets the transmission frequency of the SBA. The table shown below lists the selectable frequencies. <Default = N>

1. 'A' = Increases the transmission frequency by 100 HZ.

2. 'B' = Decreases the transmission frequency by 100 HZ.

3. 'C' = Increases the transmission frequency by 1 KHZ.

4. 'E' = Decreases the transmission frequency by 1 KHZ.

5. 'N' [0] = NOR. Sets the transmission frequency to the normal rate of 1 MHZ.

Zero Crossing Deviation (Zero Xing)

This variable is for selecting the degree of deviation to be transmitted by the SBA when a "Zero Xing" error is selected on a BC or RT page. This variable is necessary to specify the direction and magnitude of this error when called up on a BC or RT page. There are four deviation options to choose from: <Default =0>

1. 'A' = <150 nSEC
2. 'B' = >-150 nSEC
3. 'C' = >150 nSEC
4. 'D' = <-150 nSEC

i.e. <-150 could =-160
>-150 could =-110

ZERO CROSSING OPTIONS

Function Definition (Function)

The SBA contains a 256-word function buffer which can replace any words of the data buffer to be transmitted by a BC or RT. There are two types of functions which can be in the function buffer; random or sawtooth (sawtooth functions vary linearly with time between two values). To fill the function buffer with random data enter 'R' [1]. To fill the function buffer with values from a sawtooth function enter 'S' [0]. The following four sections need defining for sawtooth functions. Only the "STEP" variable is defined for both random and sawtooth functions.

UPPER LIMIT - Any integer from 0 to 65535 may be entered to define the upper limit of a sawtooth function.

LOWER LIMIT - Any integer from 1 to 65535 may be entered to define the lower limit of a sawtooth function.

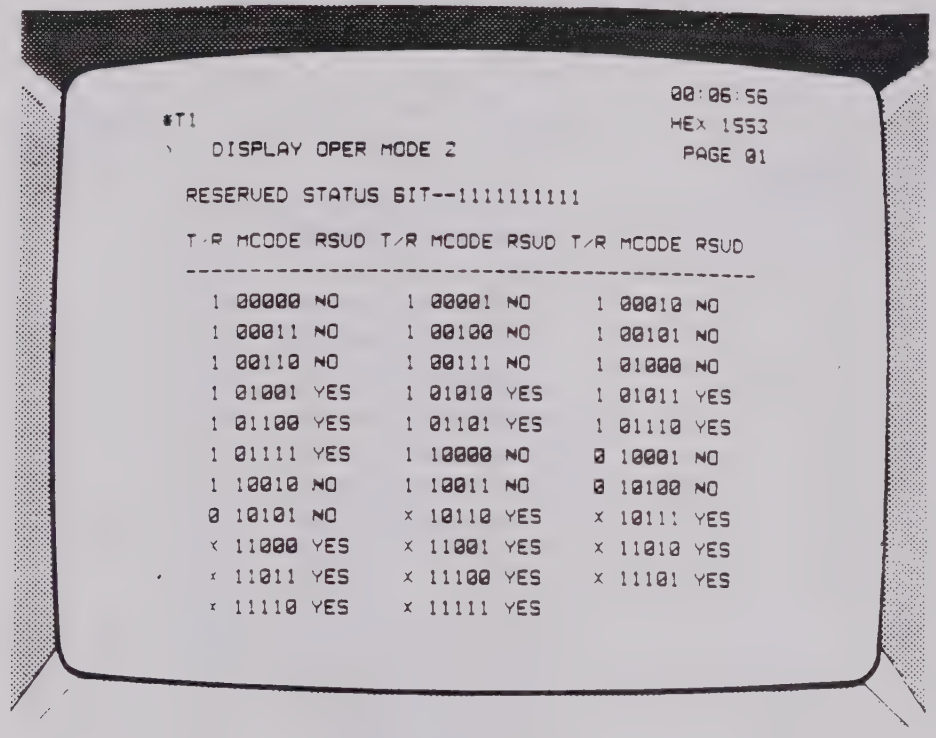
CYCLE - Any integer from 0 to 128 may be entered to define the number of complete sawtooth periods.

STEP - Any integer from 1 to 99 may be entered to define the number of times each random or sawtooth value will be transmitted before the ensuing data word.

NOTE: THE RANDOM FUNCTION IS USED FOR NOISE TESTS. WHEN THE FUNCTION BUFFER IS CHOSEN, THE DATA WORDS CHANGE WITH EACH TRANSMISSION. SAVE DESIRED DATA WORDS BEFORE EXECUTING A NOISE TEST.

MODULE 2.2 OPERATION MODE 2 PAGE

This page defines the **status word** bits and mode codes which will be detected as errors by the SBA.



```
                                                    00:06:56
#T1                                                 HEX 1553
    DISPLAY OPER MODE 2                             PAGE 01

  RESERVED STATUS BIT--1111111111

  T/R MCODE RSVD T/R MCODE RSVD T/R MCODE RSVD
  ------------------------------------------
    1 00000 NO     1 00001 NO     1 00010 NO
    1 00011 NO     1 00100 NO     1 00101 NO
    1 00110 NO     1 00111 NO     1 01000 NO
    1 01001 YES    1 01010 YES    1 01011 YES
    1 01100 YES    1 01101 YES    1 01110 YES
    1 01111 YES    1 10000 NO     0 10001 NO
    1 10010 NO     1 10011 NO     0 10100 NO
    0 10101 NO     X 10110 YES    X 10111 YES
    X 11000 YES    X 11001 YES    X 11010 YES
    X 11011 YES    X 11100 YES    X 11101 YES
    X 11110 YES    X 11111 YES
```

TO DISPLAY THIS PAGE ENTER '**DO2**' [D1].

The ten reserved status bits (shown above the mode code paragraph) correspond to the ten least significant bits of the status word. Entering a '1' in a bit position will cause a stabit error to be displayed on a bus monitoring page whenever a 1 appears in the same bit location in the status word. Entering a '0' in a bit position causes a "STABIT" error to be displayed if the corresponding status bit is set to zero. Entering an '**X**' [2] in any position causes the bit to be ignored; no flag effected.

The mode code paragraph allows the operator to define a mode code as reserved or not reserved. The T/R column indicates the transmit (1)/receive (0) bit necessary for the mode code. The cursor must be moved to the desired mode code. Entering a 'Y' [1], for YES, will reserve the mode code. The SBA will generate an error flag (RMODE) if any of the commands detected are defined by a reserved mode code. Entering a 'N' [0], for NO, indicates the mode code is not reserved; no flag effected.

Transmit-receive bit	Mode code	Function	Associated data word	Broadcast command allowed
1	00000	Dynamic bus control	No	No
1	00001	Synchronize	No	Yes
1	00010	Transmit status word	No	No
1	00011	Initiate self-test	No	Yes
1	00100	Transmitter shutdown	No	Yes
1	00101	Override transmitter shutdown	No	Yes
1	00110	Inhibit terminal flag bit	No	Yes
1	00111	Override inhibit terminal flag bit	No	Yes
1	01000	Reset remote terminal	No	Yes
1	01001	Reserved	No	TBD
↓	↓	↓	↓	↓
1	01111	Reserved	No	TBD
1	10000	Transmit vector word	Yes	No
0	10001	Synchronize	Yes	Yes
1	10010	Transmit last command	Yes	No
1	10011	Transmit bit word	Yes	No
0	10100	Selected transmitter shutdown	Yes	Yes
0	10101	Override selected transmitter shutdown	Yes	Yes
1 or 0	10110	Reserved	Yes	TBD
↓	↓	↓	↓	↓
1 or 0	11111	Reserved	Yes	TBD

Note: TBD — to be determined.

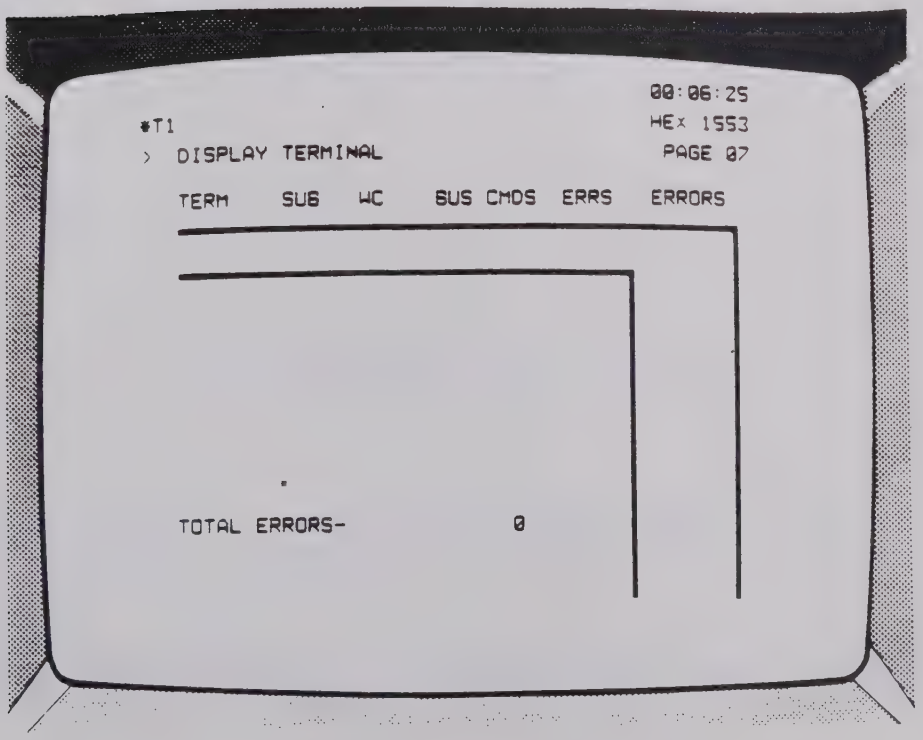
MODULE 3 BUS MONITORING

The SBA has four pages that provide a dynamic statistical display of the 1553 bus activity: Stack Page, Terminal Page, Terminal Activity Page, and the Terminal Error Page. These are display pages only. However, there are two pages that allow the operator to select or specify the bus activity for display: the Capture Page, and the Priority Page. (The Priority Page is not available with SBA-100's) These pages allow the bus message to be specified and allow the error checking sequence to be changed, respectively.

Terminal Page

The purpose of the Terminal Page is to display all bus activity detected by the SBA (in columnar form). The displayed activities include:

COMMAND WORD (TERMINAL ADDRESS, T/R BIT, SUBADDRESS AND WORD COUNT)
BUS SELECTION (PRIMARY OR SECONDARY)
TOTAL NUMBER OF COMMANDS
TOTAL NUMBER OF ERRORS DETECTED
LISTING OF ERROR TYPE



TO DISPLAY THIS PAGE ENTER 'DT' [D7] OR 'DTxx' [D7xxyy] WHERE xx REPRESENTS A SPECIFIC TERMINAL.

TO CLEAR OR RESET THIS PAGE ENTER 'DTC' [D7C].

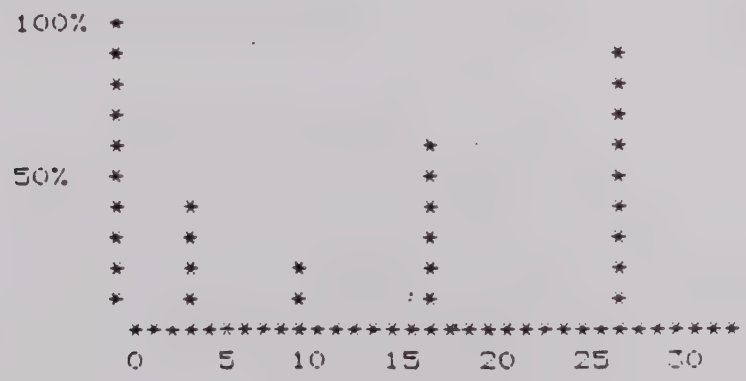
The error types listed in the right-most column are for the command word that appears between the horizontal lines. Errors which are displayed on this page include:

NORESP	INVSYN	HIWORD	PARITY
BITERR	TWOBUS	LOWORD	TA-ERR
STABIT	LOBIT	MEBIT	RMODE
HIBIT	EARLY	GAP	

By using the increment and decrement keys, the operator may scroll to any command messages detected by the SBA. The terminals shown in the two left-most columns are displayed in sequential order, not in the order of transmission.

Terminal Activity and Error Activity Pages

The Terminal Activity and Error Activity Pages display bus activity is histogram form. The vertical axis represents activity percentage, and the horizontal axis represents the terminal number (1-32). The terminal with the most activity is shown operating at 100%. All other terminals are compared to that operating percentage.

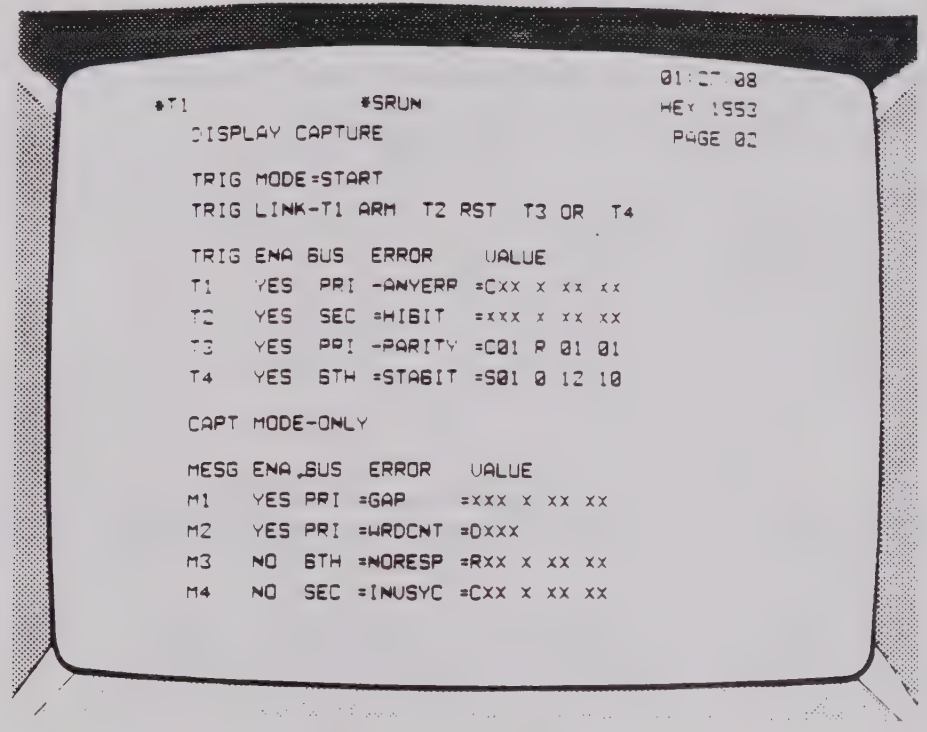


TO DISPLAY THE TERMINAL ACTIVITY PAGE ENTER 'DTA' [D7A]. TO DISPLAY ACTIVITY OF A SPECIFIC TERMINAL ENTER 'DTAxx' [D7Axx] WHERE xx REPRESENTS THE TERMINAL ADDRESS.

TO DISPLAY THE TERMINAL ERROR ACTIVITY PAGE ENTER 'DTE' [D7E]. TO DISPLAY ACTIVITY OF A SPECIFIC TERMINAL ENTER 'DTExx' [DTExx] WHERE xx REPRESENTS THE TERMINAL ADDRESS.

Capture Page

The Capture Page defines the conditions (trigger conditions) for selecting bus data for display on the stack page. These trigger conditions are the Trigger Mode, the Trigger Link, the Trigger Definition, and the Capture Mode.


01:27:08
*T1 *SRUN HEX 1553
DISPLAY CAPTURE PAGE 02
TRIG MODE=START
TRIG LINK-T1 ARM T2 RST T3 OR T4
TRIG ENA BUS ERROR VALUE
T1 YES PRI -ANYERR =Cxx x xx xx
T2 YES SEC =HIBIT =xxx x xx xx
T3 YES PRI -PARITY =C01 R 01 01
T4 YES BTH =STABIT =S01 0 12 10
CAPT MODE-ONLY
MESG ENA BUS ERROR VALUE
M1 YES PRI =GAP =xxx x xx xx
M2 YES PRI =WRDCNT =Dxxx
M3 NO BTH =NORESP =Rxx x xx xx
M4 NO SEC =INUSYC =Cxx x xx xx

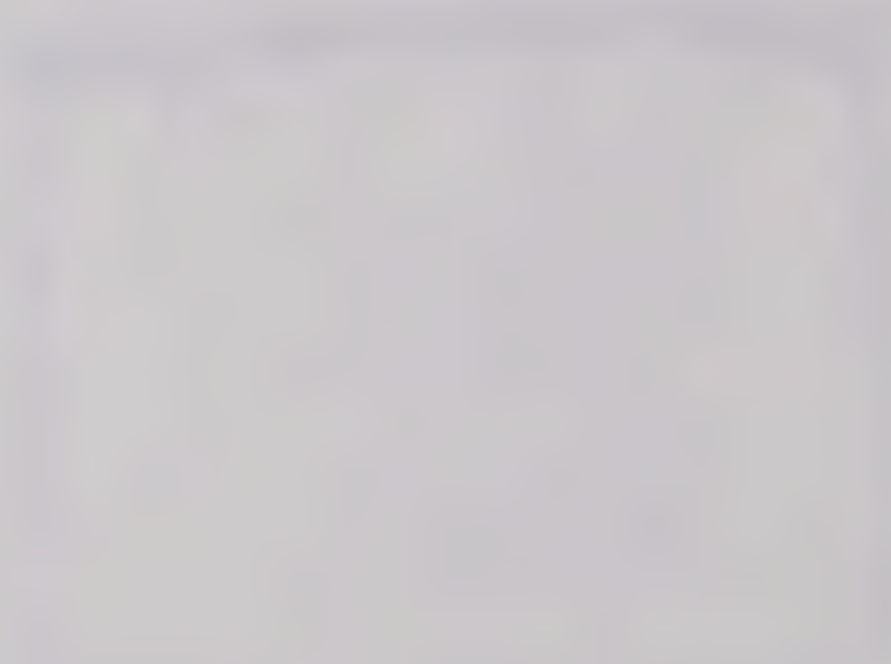
Trigger Mode

The Trigger Mode defines the starting time the stack is to fill with data. There are three options to choose from.

1. 'S' [O] = **Start.** upon detection of the trigger condition, including the trigger word, the stack will fill with data (2 K).

2. 'C' = **Center.** Upon detection of the trigger condition, the stack will capture only the data preceding the trigger that is within the message. The trigger will occur in the middle of the stack,and the lower half of the stack (1 K) will fill with bus traffic.

3. 'E' = **End.** Upon detection of the trigger condition, the stack will capture only the data proceding the trigger that is within the message. The trigger occurs at the end of the stack.



Trigger Link

This line links the trigger conditions (T1-T4) together and alters their stack capturing influence. Three are three options to choose from:

1. 'O' [0] = **Or.** This informs the SBA that the condition either preceding or following will satisfy the trigger condition.

2. 'A' = **Arm.** This informs the SBA that the condition preceding this linking word must occur before the ensuing trigger conditions are used.

3. 'R' [2] = **Reset (RST).** This causes the SBA to RESET the the trigger link if the ensuing condition is met before the preceding condition.

Trigger Definition

This paragraph has four independent trigger conditions which may be programed to set a capture sequence; each trigger is programed identically (left to right).

ENA. - Enable is the first parameter to be defined. The options are entering "Y" [1] for **YES**, and entering 'N' [2] for **NO**. <Default = 1 for T1, Default = 0 for T2-T4.>

BUS. - Bus is the second parameter to be defined. The bus options are entering 'P' [0] for **PRIMARY**, entering 'S' [1] for **SECONDARY** and entering 'B' for **BOTH**. <Default = 0>

ERROR. - Error is the third parameter to be defined. The error option and type are selected. Placing an '=' [0] before the error type will cause only the selected error to be captured by the SBA. Placing an '-' [1] before the error type will cause any error except the one selected to be captured. To enter an error type enter the first letter of the error, or use the INCR/DECR keys to scroll to the desired error. The operator may select any of the following errors for this parameter:

NORESP	INVSYN	HIWORD	ANYERR	BITERR
TWOBUS	LOWORD	LOBIT	MEBIT	GAP
RMODE	PARITY	EARLY	TA-ERR	

(See the ERROR DISCUSSION section of MODULE 4.)
NOTE: the error condition will only trigger if the respective word in the value column contains the error.

Value

This parameter defines the word and search parameters that will cause a STACK trigger.. The search parameter is set by entering an '=' [0] or a '-' [1]. If an '=' is entered, then only the following data bus word will cause a stack trigger. If a '-' is entered, the stack will trigger on anything but the following bus word. Any 1553 word may be entered. The following described word formatting for the Capture Page.

Command Word - The Command word format is divided into four hex sections (from left to right): the Command word symbol "C" and the terminal address; T/R bit; subaddress/mode code; and the data word count. Any of these sections may be changed at will. [T/R bit: 1 = Transmit, 0 = receive] <Default T/R bit = 0]

Status Word - A Status word is divided into four hex sections (left to right): The Status word symbol "S" [1] and RT address; the Message Error bit; the Service Request and three reserved bits; the Broadcast Command, Busy, Subsystem Flag, Dynamic Bus Control, and Terminal Flag bits.

Data Word - A Data word has the symbol "D" at the beginning and displays, in hex, its 16 data bits.

The Symbol "X" [5] represents "Don't Cares." Use the symbol "R" [4] for the second command word of an RT-to-RT transfer. Use the symbol "N" [3] for new Command words.

Capture Mode

The Capture Mode defines the amount of bus traffic between two trigger conditions. Entering 'A', for **ALL**, causes the SBA to allow all triggered bus traffic enter the stack until its full. Entering 'O', for **ONLY**, causes the SBA to only let data defined in the Message paragraph (below the Capture Mode) to enter the stack.

Message Paragraph

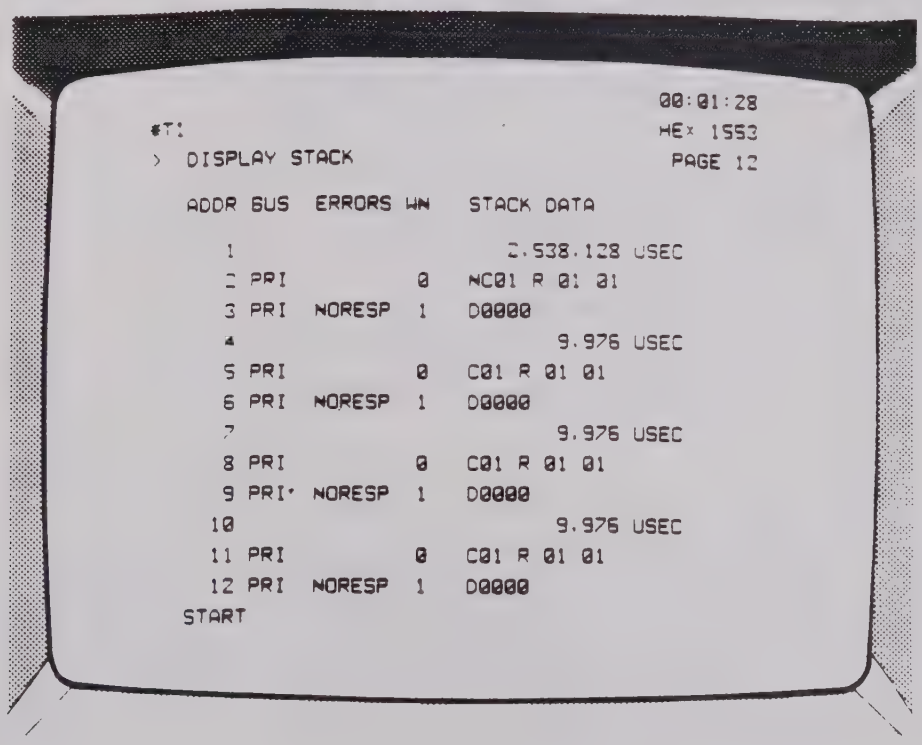
The Message paragraph configures a bus message to be captured on the stack and is programed identically as the trigger condition. (See the Trigger Condition discussion)

RUN STACK

TO INITIATE THE STACK STORAGE PROCESS ENTER 'R' [9] FOR RUN STACK.
TO HALT STACK OPERATIONS ENTER 'HS' [51] FOR HALT STACK.

STACK PAGE

The Stack Page contains selectively captured bus information in a 2048-word stack memory. The user should verify the programing of both Operation Mode Pages, the Capture Page, and the Priority Page. The Stack Page presents its information in five columns: ADDR, BUS, ERRORS, WN , and STACK DATA.


00:01:28
#T:
HEX 1553
> DISPLAY STACK
PAGE 12
ADDR BUS ERRORS WN STACK DATA
1 2.538.128 USEC
2 PRI 0 NC01 R 01 01
3 PRI NORESP 1 D0000
4 9.976 USEC
5 PRI 0 C01 R 01 01
6 PRI NORESP 1 D0000
7 9.976 USEC
8 PRI 0 C01 R 01 01
9 PRI NORESP 1 D0000
10 9.976 USEC
11 PRI 0 C01 R 01 01
12 PRI NORESP 1 D0000
START

ADDR - The address column numbers the stack addresses from 1 to 2048 (decimal). When a Trigger word is detected, the letter "T" precedes the address.

BUS - This column indicates on which bus (primary or secondary) the word was monitored.

ERRORS - This column displays the highest priority error detected in the captured message for the respective address. (The Priority Page sets error priority)

WN - This column displays the word position in each message. Command and Status words are counted with 0's and Data words are numbered in consecutive order.

STACK DATA - This column displays the captureed bus message preceded by timing information for that message. The timing information displayed before the word message represents, in milliseconds, the time lapsed between successive bus commands (+/- 4 uSEC)

C - Precedes Command words
N - Precedes new Command words
R - Precedes the second command of a RT-to-RT transfer.
S - Precedes Status words
D - Precedes Data words.

(See the Capture Page - Trigger Value discussion for word formats)

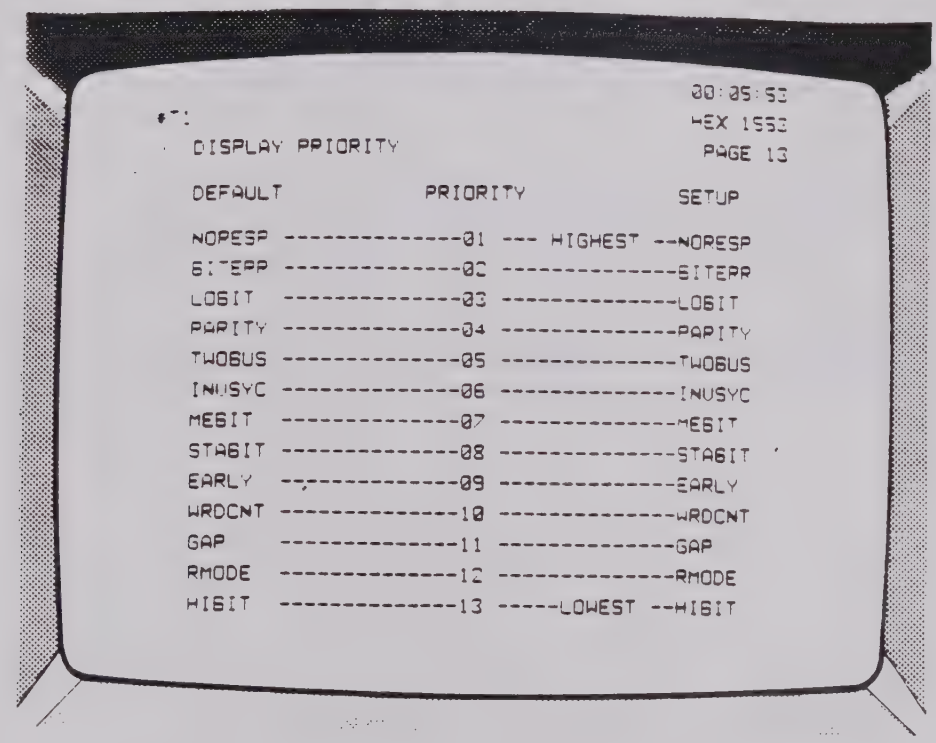
Displaying Stack Values

The "Display Stack Value" command allows the operator to search for a captured sequence in the stack (up to 34 words long). Enter 'DSV' [DEA] and immediately enter the sequence to be located (a "------" signifies the end of string). To scroll a previously entered sequence, enter 'DSVA' [DEAA] and use the "A/B" keys to increment or decrement the sequence, respectively. (Scrolling starts with the second value in the sequence)

NOTE: TO SCROLL THE STACK's ADDRESSES, DISPLAY THE STACK PAGE AND USE THE INCREMENT OR DECREMENT KEYS COMBINED WITH THE REPEAT KEY.

PRIORITY PAGE

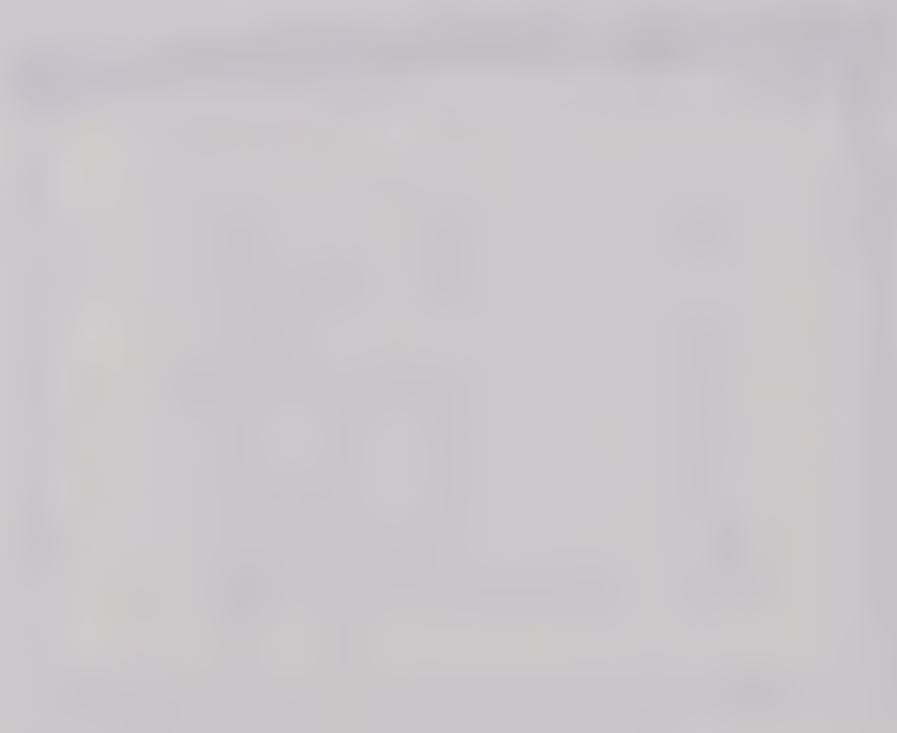
The Priority Page displays the current selective activity monitor error-checking sequence and allows the sequence to be altered. This page is made up of three columns: DEFAULT, PRIORITY, and SETUP. The DEFAULT column shows the error-checking sequence in effect when the SBA is initialized. The PRIORITY column shows, from highest to lowest, the order of the error-checking sequence. The SETUP column lists the error order selected by the operator.



TO DISPLAY THIS PAGE ENTER '**DP**' [D3].

When the SBA is first powered-up, the DEFAULT and SETUP columns are identical. To change the error-checking sequence, move the cursor down to the desired location and either enter the first letter of the desired error, or use the INCREMENT/DECREMENT keys to scroll through the error list.

The "STABIT," "RMODE," and "MEBIT" errors are always checked in the order they appear in the DEFAULT column when two or more these errors occur simulatneously.



EXTERNAL SETUP

To monitor an external bus, perform the following:

1. Connect the coupling stub to the external, programable connection (**EXT/VAR**) on the back of the SBA.

2. On the Operation Mode 1 Page, select the appropriate coupling on the "**BUS SELECT**" line, either transformer (**XMF**) or direct (**DIR**). (See Module 2)

3. If a BC or RT is required to complete the system configuration, setup the respective page. The Frame Format Page requires setup for simulated BC transmission. (See module 4.)

4. Display the Terminal Page (enter '**DT**' [**D7**]) to view bus traffic. To view bus activity, enter '**DTA**' [**D7A**] for "Display Terminal Activity." To view bus error activity enter '**DTE**' [**D7E**]. (See module 3.)

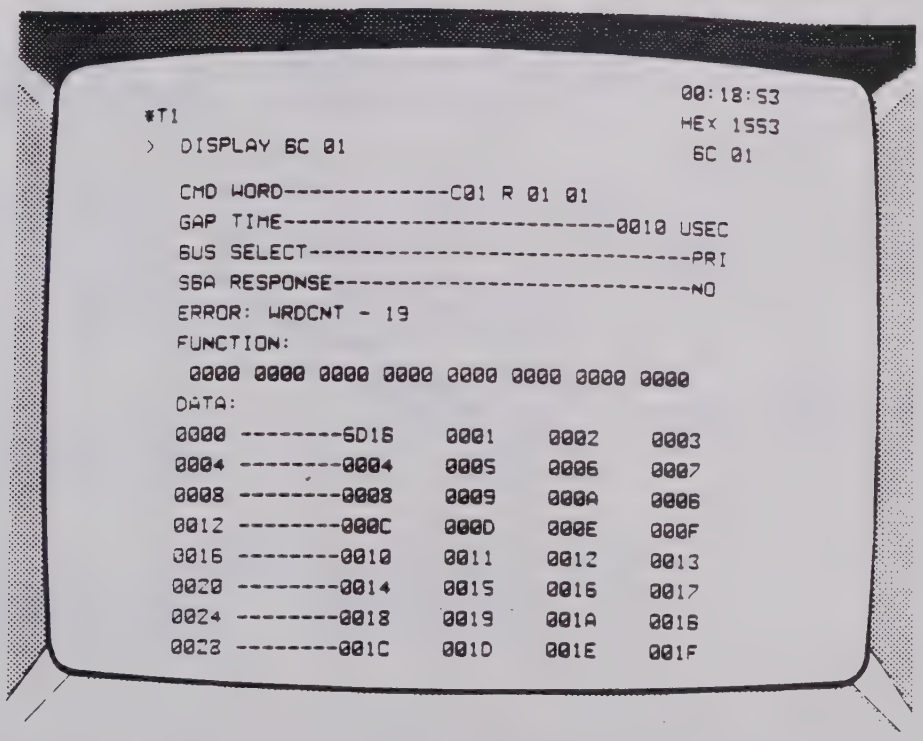
5. If a specific message or trigger is desired for viewing from the bus traffic, setup the Capture Page to define the parameters. The Stack Page displays captured bus traffic.

MODULE 4 TERMINAL SIMULATION

The SBA is capable of simulating 32 Bus Controller (BC) messages and 32 Remote Terminals (RT). Each BC page configures one command message and data words (if any) associated with the message. Each RT page configures the Command, Data, and Status word which the RT will respond and transmit. The following describes the procedure for configuring BC and RT simulation.

Bus Controller Simulation

A Bus Controller is the terminal assigned the task of initiating information transfers on the 1553 bus. The top half of a BC page defines the Command word, Gap Time, Bus Selection, SBA Response, and Error injection. The lower half defines the Data words associated with the BC Command word. The following BC page discussion describes the page line-by-line, top-to-bottom.



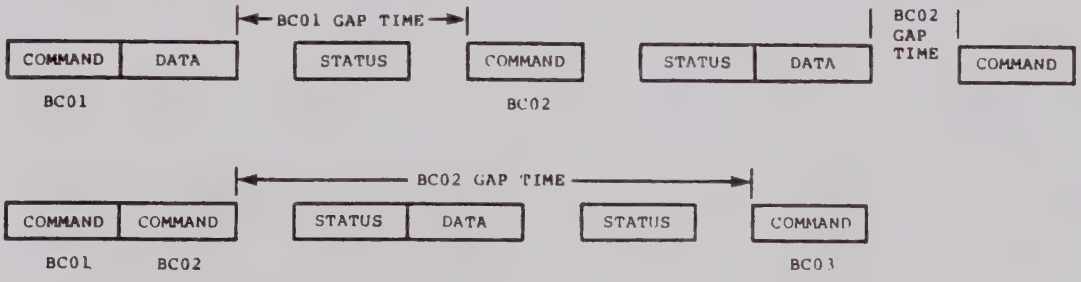
TO DISPLAY A BC PAGE ENTER '**DBxx**' WHERE xx REPRESENTS THE BC PAGE NUMBER (1-32).

Command Word

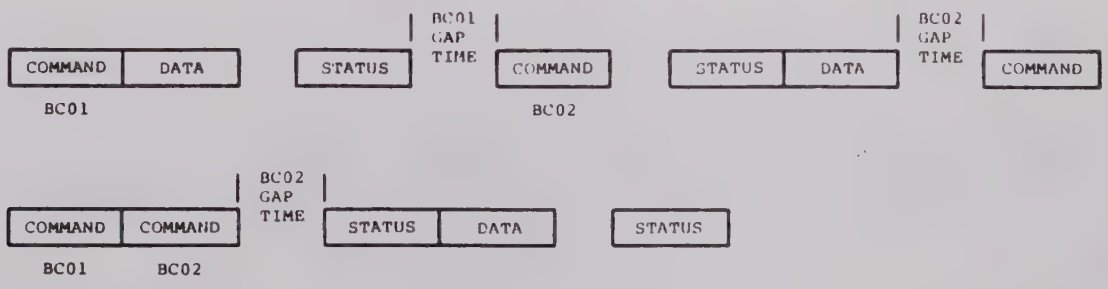
This line represents the Command word to be transmitted. The Command word format is divided into four hex sections (left to right): Command word symbol "C" and RT address; T/R bit; Subaddress/Mode Code; Data Word Count. Enter the desired format. [T/R conversion 1 = transmit, 0 = receive] <T/R bit default = 0>

Gap Time

The Gap Time variable is used to select the dead bus time that occurs between SBA BC messages. In the case of a external RT, the Gap time is measured from the mid-parity of the last word of the message to the next SBA generated command.



In the case of an internal RT, the Gap time is measured from the mid-parity of the status word to the Mid-sync of the next command word. This variable is an SBA configuration for allowing enough time on the bus to complete all transmission in the 1553 system. The selectable Gap range is from 0001 uSEC to 9999 mSEC. <Default on BC 01 Page = 0001 uSEC , all other BC Pages = 0001mSEC>



Bus Select

This variable selects whether the BC will transmit on the Primary or Secondary bus. Enter 'P' [0] for the Primary bus; enter 'S' [1] for the secondary bus. <Default = 0>

SBA Response

This variable informs the SBA to expect a response from an internal RT. Entering a 'Y' [1] tells the SBA to expect a response from an internal RT. Entering a 'N' [0] tells the SBA to expect a response from an external RT. <Default = 1 on BC Page 01 only, default = 0 on all other BC pages>

Error

Any one of 10 errors may be entered on this line. The error entered will be injected on the bus for analysis of an RT's response. For a detailed explanation see the error discussion at the end of this module.

Function Line

Each BC Page displays eight groups of four digits which correspond to the 32 data words shown below this function line. The left-most digit corresponds to the least significant data word, and the right most digit corresponds to the most significant data word. When these digits on the function line are changed (the operator can only enter 1's and 0's), the value of the corresponding data word may change. Entering a '1' in a digit position tells the SBA to draw the corresponding data word from the function buffer. When the function buffer is chosen, the programed data word shown below the line will display the type of function (either random or sawtooth). The type of function is chosen on the Operation Mode 1 Page. Entering a '0' in a digit position tells the SBA to draw the corresponding data word from the data buffer.
<Default = 0>

Data Words

Each BC page displays a block of 32 data words selected from a 700-word data buffer. The corresponding addresses for these words (0000-0698) are shown on the left side of the CRT. The operator may enter any address from 0000 to 0667 in the top-most address; the remaining 31 addresses will follow in sequential order.

Filling the Data Buffer

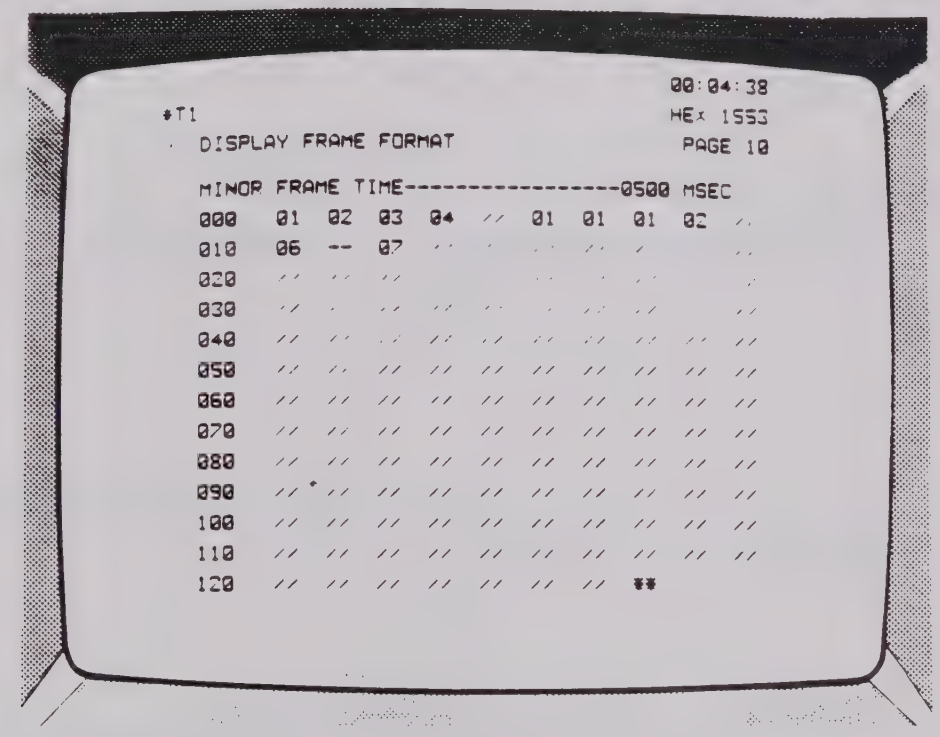
To fill the data buffer with a specified value, enter 'FDxxxx,yyyy zzzz' where xxxx represents the starting address, yyyy represents the ending address, and zzzz represents the value to be entered in the block.

Changing Data Words

To change a single data word value enter 'CDxxxx where xxxx represents the address of the data word. The cursor will flash next to the address awaiting the entry of the new value. The operator may initiate by either pressing a carriage return, or by using the increment/decrement keys to scroll through desired sequential addresses to enter more changes.

FRAME FORMAT PAGE

The Frame Format Page is used to establish the order of BC message transmission. A BC message will not transmit unless the BC page on which its command is configured appears on the Frame Format Page (actually the BC PAGE NUMBER appears on the Frame Format Page).



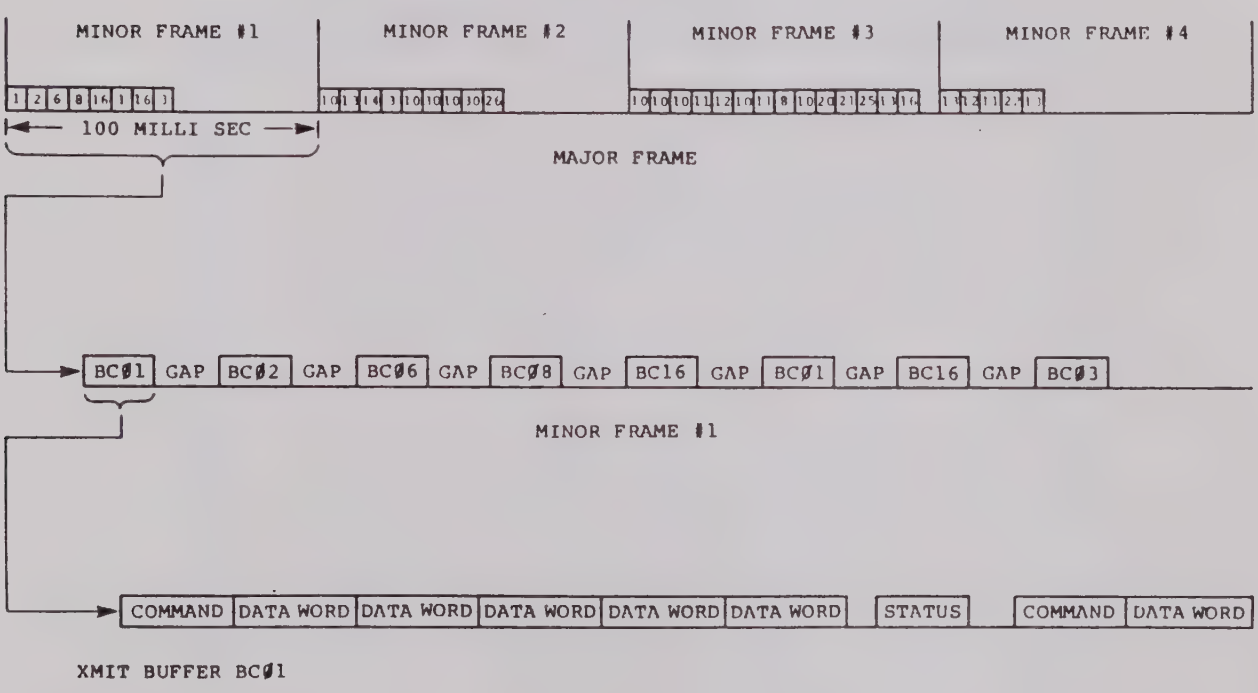
TO DISPLAY THIS PAGE ENTER '**DF.**'

A series of BC commands (page numbers) may be associated as a group called a Minor Frame. The Frame Format Page may contain multiple Minor Frames. All Minor Frames are transmitted within the Minor Frame Time entered at the top of this page.

The collection of all the Minor Frames is called a Major Frame. This includes The BC page numbers, Minor Frame delimiters and RT-to-RT specifiers. Each of these entries shall be discussed in the following paragraphs.

Minor Frame Time

The Minor Frame Time consists of all times associated with message tranmission: intermessage gap; response; any time delays; and 20 microseconds for each word occurring on the 1553 bus. The value entered represnts the time EACH Minor Frame on this PAGE will take to be executed. Thus, if one Minor Frame does not take as long to be executed as another, the remaining time is dead bus time. Any time from 0001 to 9999 mSEC may be entered.



Minor Frame Programing

To program a Minor Frame enter 'CFxxx' for change frame and slot address (xxx). The address and the value for the address are separated by an "=" (value is on the left). The new slot value is entered next to the previous contents. By using the "INCR/DECR" key the slot addresses may be scrolled for programing.

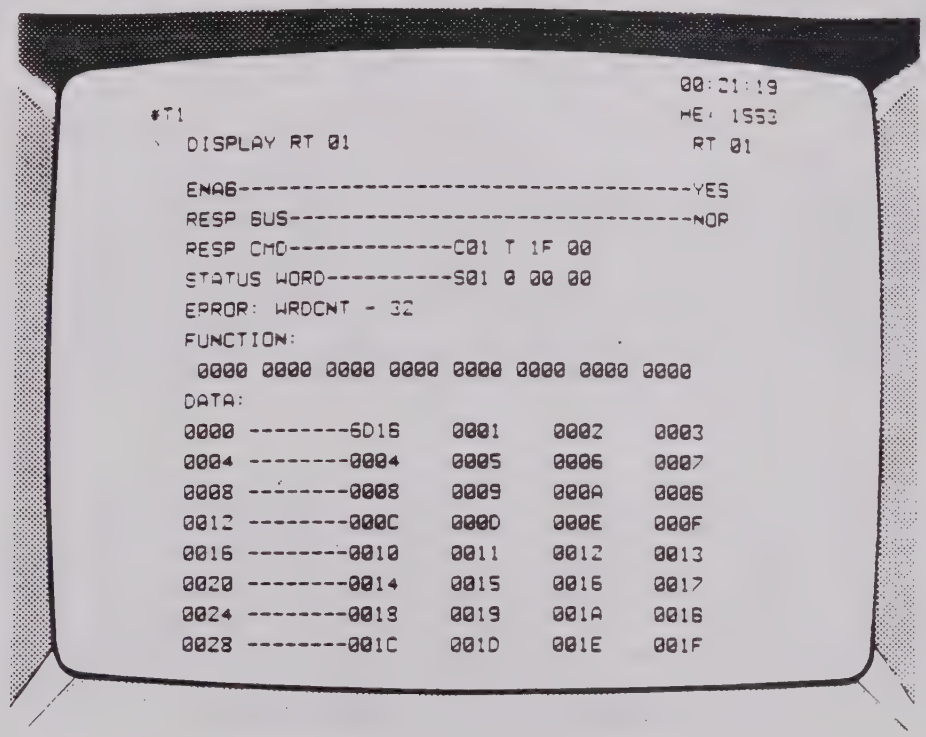
Entering BC Series and Selective Symbols

Entering a series of BC Page numbers creates a Minor Frame. The operator must enter a BC Page numbers one slot at a time. Minor Frames can be separated by entering '/' [E] and a "//" will appear (this is also used for clearing desired slots). If the BC command is for an RT-to-RT transfer enter '-' [D] between the BC numbers (a "--" will appear). To end a Major Frame enter '*' [F] (a "**" will appear).

NOTE: WHEN ISSUING AN RT-to-RT TRANSFER, THE RECEIVING RT MUST RECEIVE ITS COMMAND FIRST.

REMOTE TERMINAL PAGES

A Remote Terminal (RT) is the terminal assigned the task of talker/listener on the 1553 bus. Each of the 32 RT pages may be used to configure the SBA to a BC command. The top half of an RT page defines the RT operation, Bus Selection, Command Word Response, and error injection. The lower half defines the data words associated with an RT transmit command. The SBA priority for enabling an internal RT for response from a BC starts with the 32nd RT and works sequentially to the first. The following explanation of an RT page is line-by-line, top-to-bottom.



TO DISPLAY THIS PAGE ENTER '**DRxx**' [D4xx] WHERE xx REPRESENTS THE PAGE NUMBER.

Enable

This variable enables or disables the RT page for response. Enter 'Y' [1] for YES; enter 'N' [0] for NO. <Default = 0>

Bus Response

This variable selects the Bus on which the RT will respond. Entering 'N' [0] tells the RT to respond on the bus that the command was received on (the NORMAL mode). Entering an 'I' [1] tells the RT to respond on the opposite (INVERTED) from which the BC command was received. Entering a 'P' [2] tells the RT to respond on the PRIMARY bus. Entering a 'S' [3] tells the RT to respond on the SECONDARY bus. <Default =0>

Command Response

The RT shall respond to the programed command word contained on this line. The command word format is divided into four sections (from left to right, hex): command word symbol "C" and terminal address; T/R bit; subaddress/mode code; and data word count. Any of these sections may be changed at will. Also, "DON'T CARES" may be placed in any of the fields by entering 'X' (can not be entered from the keypad). [T/R bit conversion: transmit = 1, receive = 0] <Default = 0>

Status Word

This line defines the status response of the simulated RT for the command word sent to the RT (command response). The status word is divided into four sections (hex): Status Word symbol "S" and RT address; the Message Error bit; Instrumentation, Service Request, and three reseved bits; and the Broadcast Command Received, Busy, Subsystem Flag, Dynamic Bus Control, and Terminal Flag bits. Also, "DON'T CARES" may be placed in any of the fields by entering 'X.'

Error

Any one of 10 errors may be entered on this line to inject an error on the 1553 bus. See the error discussion section at the end of this module.

Function Line

This line is identical to the Function Line on the BC page. See the first section of this module: BC PAGE.

SIMULATION EXECUTION

After the Operation Mode 1 and the Frame Format pages have been programed:

1. Establish a BC and/or RT for commands and/or response, respectively.

2. Enter 'XF' [XMIT button] causing an infinite execution of the Frame Format order, or enter 'X----' [1----] to

   execute the Frame Format the specified number of times as entered in the blank spaces.

3. Bus activty may be monitored on the Terminal Page, enter 'DT' [D7].

4. Entering 'H' [HALT button] will cause the SBA to cease transmission.

RT-to-RT Transfers

To initiate an RT-to-RT transfer using an SBA internal Bus Controller, perform the following.

1. Setup a BC to issue a Receive command to the desired RT.

2. Setup a second BC to issue a transmit command to the desired RT.

3. Setup the Frame Format page to transmit the BC issuing the receive command first. Followed by the RT-RT transfer symbol "--," and then enter the second BC that is issuing the RT transmit command.

Mode Code Simulation

The SBA is capable of simulating a 1553 Mode Code with the programing of the Operation Mode 1 and 2 , BC, and RT pages. To transmit a Mode Code over the 1553 bus from the SBA perform the following:

1. Setup the Operation Mode 1 and 2 Pages. On the Operation Mode 2 Page, the Mode Code desired should not be reserved.

2. If an internal BC is being used, setup a BC page and entered the desired Mode Code format in the command word.

3. If an internal RT is being used, setup a RT page and enter the desired Mode Code format in the command word. On the error line enter a "WORD COUNT" error with a value the same, but negative of the word count/mode code field of the command word.

i.e. The command word format may be "C01 T 00 06." The error line would display "WRDCNT - 06." This is necessary so data words are not transmitted.

NOTE: SOME MODE CODES DO REQUIRE TRANSMISSION OF A DATA WORD. TAKE THIS INTO CONSIDERATION WHEN CALCULATING THE WORD COUNT ERROR COUNT.

BC and RT Error Discussion

The SBA has sophisticated error injection capabilities. Errors may be programed on RT or BC page; only one error type can be programed per page. The following is a list of error injection commands which can be programed at the "ERROR:" line of a BC or RT page:

ENCODE	PARITY
ZERO CROSSING	NOISE GATE
XMIT ON BOTH BUSES	SYNC
GAP	WORD COUNT
BIT COUNT	RESPONSE TIME

Most errors can be encoded as either FIXED or RIPPLED. A FIXED error injection requires the exact word, bit or zero crossing to be defined, as appropriate. If operating on a BC page, a "00" assigns the error function on the command word. If operating on an RT page, a "00" would assign the function to the status word. Numbers 1-32 would cause the error to affect the corresponding data words. A RIPPLE function causes the SBA to generate the error on the first bit, word or zero crossing and then increments the error through the next half bit, word or zero crossing for each message.

'Q' or 'D' ERASES AN ERROR FROM THE ERROR LINE.

IN THE FOLLOWING ERROR EXPLANATIONS A "xx" REPRESENTS THE WORD NUMBER (00-32) OR NUMBER OF WORDS IN THE TRANSMISSION MESSAGE IN WHICH THE ERROR IS INJECTED; A "yy: REPRESENTS THE BIT-TIME OR NUMBER OF BIT-TIMES IN WHICH THE ERROR IS INJECTED; "zz" REPRESENTS A TIME IN MICROSECONDS NECESSARY FOR A GIVEN ERROR; A "w" REPRESENTS THE BINARY DIGIT FOR THE ENCODED WORD.

Zero Crossing (ENCODE)

This error causes low or high bit levels to be injected into the nonsync area of a command, status or data word. The bit-times are numbered from left to right (1-17) beginning after the last sync bit-time. A fixed high encoding can be achieved by entering: 'EF xx B yy H' [E1 xx B yy 0]. A fixed low bit encoding can be achieved by entering 'EF xx B yy L' [E1 xx B yy 1]. A ripple high bit encoding can be achieved by entering 'ER xx H' [E0 xx 0]. A ripple low bit encoding can be achieved by entering 'ER xx L' [E0 xx 1].

Parity

The Parity error causes an inverted sync to be encoded in a specific word or rippled through a message. A fixed Parity error can be achieved by entering 'PF xx' [21 xx]. a ripple through parity error can be achieved by entering 'PR' [20].

Zero Crossing

The zero crossing error causes the zero crossing of a specified bit and word location to deviate by the amount specified on the Operation Mode 1 Page. There are 35 consecutive locations where a zero crossing error can occur: "00" being the sync mid-bit crossing, and "34" being the parity bit crossing. All even crossing selections are mid-bit locations.

A fixed zero crossing can be achieved by entering 'ZF xx ww' [61 xx ww].

A ripple zero crossing error can be achieved by entering 'ZR xx' [60 xx].

Noise Gate

The noise gate is the only "ERROR:" line selection that is not a 1553 error. Also, this entry can only be used on BC pages. This entry is used with noise tests to control an external noise source while the SBA transmits. The noise turns on 10 uSEC prior to SBA transmission and turns off for a range of 1.0 to 10.0 uSEC.

Setting the noise gate is achieved by entering 'N zz' [A zz].

See Module 8. for more information on noise tests.

XMIT on both Buses

This transmission entry causes the BC or RT to transmit on the primary and secondary buses at the same time.

This entry is achieved by entering 'X' [8].

NOTE: THIS ERROR IS NOT A SUPERCEDING COMMAND INJECTION.

Sync

This error causes a deviation in the sync bit-time field. Sync errors are encoded by the half bit-time; therefore there must be six binary digits entered to select the desired sync. The sync error selections available for command and status words are: 111100, 111001, 100111. The sync error selections available for data words are: 000110, 001111, 011000.

A fixed sync error encoding can be achieved by entering 'SF xx wwwwww' [11 xx wwwwww].

A Ripple Sync error encoding can be achieved by entering 'SR xx

wwwwww' [10 xx wwwwww].

Gap

The Gap Time error can inject a Gap error between words in a message. The Gap time is selectable in 0.5 microsecond increments from 1.0 to 6.0 uSEC.

A fixed Gap time error can be achieved by entering 'G xx zz' [5xx zz].

A ripple Gap time error can be achieved by entering 'G zz' [5 zz].

Word Count (WRDCNT)

The Word Count error causes the transmission of up to four words over, or 32 under, the word count as specified in the command word. This error is also necessary for implementing Mode Codes (see the preceding section of this Module).

A word count with less data words than the word count field in the command word can be achieved by entering 'W - xx' [3 1 xx].

A word count with up to four data words more than the word count field in the command word specifies can be achieved by entering 'W + xx' [3 0 xx].

Bit Count (BITCNT)

The Bit Count error can cause an increase or decrease of the normal 16 data bits contained in the 1553 words, of a maximum 9 bits over and 3 bits under, repectively.

A fixed bit count with a greater number of bits can be achieved by entering 'BF xx +y' [B1 xx 0y].

A ripple bit count error with a greater number of bit can be achieved by entering 'BR +y' [B0 0y].

A fixed bit count with a lower number of bits can be achieved by entering 'BF xx -y' [B1 xx 1y].

A ripple bit count with a lower number of bits can be achieved by entering 'BR -y' [B0 0y].

Response Time

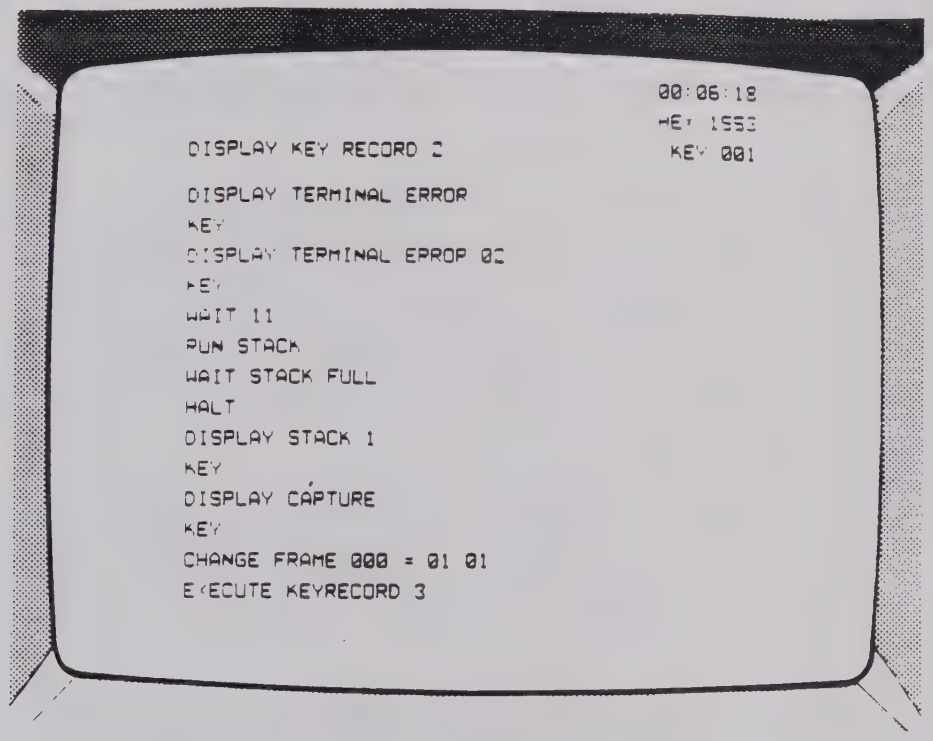
This error causes an increase in the response time from an RT and can only be entered on an RT page.

To increase the response time of an RT from 04 to 34 uSEC enter 'R zz'

[7 zz].

MODULE 5 KEYRECORD PAGES

The SBA has 254 programable pages called "KEYRECORDS." These pages allow the operator to perform a series of SBA commands to perform a function. The commands are entered on a page and the page is executed, resulting in the execution of the commands entered on the page. Keyrecords may execute other keyrecords conditionally or unconditionally; thus, lengthy operations may be performed.



Accessing and Programing Keyrecords

TO DISPLAY A KEYRECORD PAGE ENTER 'DKxxx' [D6xxx] WHERE xxx REPRESENTS THE PAGE NUMBER (1-254).

To enter commands on a Keyrecord page, cursor down to the first line of the blank page. Next, enter any SBA command on the line (most commands behave exactly as if they were entered on the Command Line). Finally, move the cursor down to the next line and either enter another command or return the cursor to the Command Line (by pressing the 'RETURN', '^', or [CR] button).

Up to 14 lines (commands) may be entered per page.

Executing Keyrecords

TO EXECUTE A KEYRECORD PAGE ENTER 'EKxxx' [E3xxx] WHERE xxx REPRESENTS THE PAGE NUMBER.

As mentioned before, keyrecords may execute other keyrecords calls, jumps, and branches. These commands are:

EXECUTE KEYRECORD xxx RETURN - ENTER 'EKxxxR' [E3xxxR]. This command executes another keyrecord (xxx). Once the command string of the called keyrecord is executed, the original execution sequence resumes directly below this command.

EXECUTE CALL TO KEY xxx condition - ENTER 'ECxxx Q.' This command CALLS another Keyrecord when the condition, Q, is met. The condition is a TRUE/NOT TRUE flag which is set with TEST data and memory commands (see Module 9.). For the condition, Q, enter 'T' [0] for TRUE, or 'N' [1] for NOT TRUE.

EXECUTE JUMP TO KEY xxx CONDITION - ENTER 'EJxxxQ' [E1xxxQ]. This command JUMPS to another keyrecord when the condition, 'Q',is met. The condition is a TRUE/NOT TRUE flag which is set with TEST data and memory commands (see Module 9.). For the condition, Q, enter 'T' [0] for TRUE, or 'N' [1] for NOT TRUE.

BRANCH on TRIGGER yyy TO KEY xxx - ENTER 'By,x.' This command executes the keyrecord page (x) when trigger (y) occurs. The trigger condition is defined on the Capture Page (see Module 3). Entering 'R' [0] at the end of the command returns the execution sequence back to the source page after BRANCH sequence has been executed.

Also, 'S' may be entered (for xxx) to branch on a Stack Full condition.

In-page Programing from Keyrecords

SBA pages displayed on a keyrecord may have their variables changed from the keyrecord page. This is accomplished by entering a Carriage Return ('RETURN' [CR]) on the line of the keyrecord which has a page display command. The page commanded on the keyrecord line to be displayed appears and is ready for programing. After, the desired programing is complete, press the 'RETURN', [CR], or '^' keys to return to the source keyrecord page. The next time the keyrecord page is executed, the page programed will appear and the changes implemented. The execution sequence then continues on the keyrecord. It is recommended the operator practice this procedure before performing a test.

Automatic In-page Variable Changes from Keyrecords

There are two functions that automatically increment or decrement in-page variables every time the source keyrecord is executed. These functions (actually control characters) are entered at a variable location when a page has been displayed from a keyrecord. These two functions are:

'CTRL F' - This function provides a single increment of a programable variable. Enter the keystroke at the variable to increment and finish programing the page. The function will not appear, but will be initated when the source keyrecord is executed.

'CTRL G' - This function is initated the same as 'CTRL F,' but this function decrements an in-page variable.

There are three function that automatically increments or decrements memory or data word values every time the source keyrecord is executed. These functions are entered at the end of a CHANGE MEMORY or DATA command. The functions are never seen when entered or displayed, but are implemented every time the source keyrecord is executed. It is recommended that the user practice these functions before implementing a test. These functions are:

'+' - This function may be entered after a value to increment the value in the command by one.

'-' - This function may be entered after a value to decrement the value in the command by one.

'<' - This function may be entered after a value to decrement the value in the command by a power of two.

Editing a Keyrecord

To **DELETE** a line, scroll down to the desired line and press '<' or 'RUBOUT.'

To **REPLACE** a line, scroll down to the desired and simply enter (write over) the new command.

To **INSERT** a line, scroll down to the desired line and enter the new command -- immediately press the '**ESC**' key and the cursor will return to the beginning of the command entered. When the cursor is returned to the command line the change will be implemented.

NOTE: IT IS RECOMMENDED STARTING A KEYRECORD PROGRAM ON KEYRECORD 1-4. THIS WAY, THE PROGRAM MAY BE STARTED BY PRESSING THE RESPECTIVE [KEY 1-4] KEY. For SBA-100F machines, KEY 1-6 apply.

NOTE: WHEN USING KEYRECORDS TO POSITION AND LOAD TAPE FILES, SEPARATE THE TWO COMMANDS ON DIFFERENT KEYRECORDS. ALSO, ONCE A TAPE FILE HAS BEEN LOADED FROM A KEYRECORD PROGRAM, THE EXECUTION SEQUENCE RETURNS TO THE KEYRECORD (1-254) WHICH CONTAINED THE "LOAD TAPE" COMMAND.

TESTING KEYRECORDS

A new command has been added to the SKEYDEF for testing keyrecords for old SBASIC tape programs. This command examines the locate word keyrecord word that contains an instruction call (BA, etc. tape command. Once the old set of keyrecords have been entered in the SBA SKEYDEF machine language, over 50 (750 on QPC), enter "K" for "TEST KEYRECORDS". The first keyrecord found with an old tape command word will be displayed. The user should scroll down and replace or remove the bad command, and then repeat the test command until "NO MORE COMMANDS FOUND" is displayed on the error line of the IRT.

NOTE: This command only tests for tape related commands. It is recommended that the user check all converted keyrecords for proper interface or memory related commands that may have transferred to an undesirable port or location.

MODULE 6
DISK DRIVE USAGE

INTRODUCTION

The main difference between the SBA-100A and the SBA-100F is the introduction of dual 5 1/4" disk drives to the system. The operations of these disk drives will be the topic of this module.

The SBA's drives are single sided and use either single sided or double sided disks that are soft sectored. The top-most drive of the SBA will always be referred to as the zero (0) drive and the lower drive will be the one (1) drive.

The drives store data (SBA MODES of operation) in groups of eight blocks and there are 624 blocks on a disk. Storage of a complete operational mode setup of the SBA requires about 30 blocks, thus a disk can store about 19 seperate files of operational mode setups (round off 30 to 32 - four groups of eight blocks for each setup).

The SBA checks for the presence of a disk in a drive upon power-up or reset and displays "DATA DISK ACCEPTED" on the top-most line of the CRT if a disk is present. The SBA does not check for the presence of a disk when a TEST SYSTEM command has been executed; simply open and close the drive's door to alert the SBA to a presence of a disk.

The first step of using the disk drives to store and retreive data is to initialize a disk.

INITIALIZING A DISK or erasing a disk

To initialize (format) a disk, place a disk in either the zero or one drive, and then enter 'I"D:XXXXXXXXXXXXX"S' where the D represents the drive specifier (0 or 1) and X represents a disk header (or label-optional), and S represents "SUPPRESS QUERIES" (optional, covered later in this module).

The drive specifier must be entered if the header option is not being used. Also, if the header option is not being used, the drive specifier does not need to be enclosed in double quotes. When using header option, the drive specifier really only needs to be used when initializing the one drive, for, the zero drive is the default drive.

```
i.e.  INIT DISK 0      INIT DISK "HEADER-DRIVE0"
      INIT DISK 1      INIT DISK "1:HEADER-DRIVE1"
```

The header name follows the same rules as file names (see the next page-DISK FILES): 13 characters maximum; the characters ", :, *, or space bar can not be used; all other keyboard characters are valid header characters and may be repeated as often as desired.

The "SUPPRESS QUERIES" option simply means the SBA will not question the user on disk operations, such as erasing a disk by initialization or the over-writing a file, etc. If this option is not used, the SBA will prompt the user "ERASE DISK?" for which the user would answer 'Y' for yes, or any other key for no. Upon the execution of the command (by pressing the carriage return key), as with any disk function, the LED of the selected disk drive will light while the operation is being executed, and when initialization is finished the light turns off. The disk is now ready for storing SBA information and setups.

i.e. INIT DISK "HEADER" SUPPRESS QUERIES
INIT DISK 1 SUPPRESS QUERIES

DISPLAYING the **DIRECTORY**

A Directory page for a drive shows the number of free blocks on the disk, a listing of the disk's files, the number of blocks allocated to each file, and the file's status (write protected or not - shown by a 'W' after the file block number). See the INTRODUCTION paragraph for disk block information.

To display a directory enter 'DDX' where X represents a drive number (0 or 1). If no drive number is specified, as with all disk operations except for the INITIALIZE command without the header option, the command will default to the zero drive. If an unformatted disk's directory is displayed, "@" signs will usually appear throughout the display.

DISK FILES

Data is stored to the disks under file names. The file names, whether saving or loading data, are enclosed by double quotation marks which the operator must enter, such as "FILENAMES". File names may be up to 13 characters and may be comprised of any keyboard characters EXCEPT double quotations, colons, asterisks, or space bars (",:,*,). These characters are used for specific disk operations which are explained below.

1. **Double Quotation ""** - This character is used to enclose disk file names, and must be entered at the beginning and end of a filename by the operator, except after 13 characters have been entered for a file name where the SBA will automatically insert the ending double quotes.

   i.e. "RT-TEST" or "13-CHARACTERS" or "TEST1.2.3.4-1"

2. **Colon :** - This character is used to separate the drive specifier number from the file name. For example, a file name may be "1:1553BUS2.TST"; this would specify that this file would be saved to or loaded from the one drive. This specifier is only really necessary for the one (1) drive because the zero (0) drive is the default setting

for all disk operations. The drive specifier does not count as part of the 13 character maximum for file names.

3. **Asterisk** * - This character is used as a wild card entry for saving or purging files on a disk, and may be placed anywhere in the file name. This function is very useful for copying multiple files from one disk to another or when purging multiple files from a disk with a single command. For example, if two files were to be saved (copied) from the zero drive to the one drive and the files had similiar names, an asterisk would be entered in place of the similar parts of the file names and a single command could be used to copy both files.

   i.e. SAVE "0:NAMES*" > "1:"
   SAVE "1:*NAMES" > "0:"

   If the wild card is placed at the beginning of a file, the files to be copied must have at least one legal character in the first position from the left (not counting the drive specifier).

   THIS CHARACTER CAN NOT BE USED WITH A LOAD COMMAND.

4. **Space Bar** - The space character can not be used in any part of a file name. Instead, any other keyboard character may be used except the ones previously listed. Valid keyboard characters may used as often as desired.

   i.e. "FILE-NAME-.9!" or "TEST1-2.3.4-?"

DISK FILE FUNCTIONS

There are four file functions which help protect, link, and/or verify disk files. To enable any of these functions, place the appropriate letter after a file name when loading or saving a file. These functions are for disk operations only. They are:

1. **Suppress Queries** (S) - This function is used to suppress the queries that question the operator on dangerous disk operations to insure that a mistake that might destroy data has not been made. An example of this is when the operator wants to initialize a disk; the SBA will ask the operator, "ERASE DISK?", to insure the operator knows that this action will erase all exsisting data from the disk being initialized. Also, a prompt will appear when duplicate file names are detected and when a file is to be purged. If however, an **S** is entered after a file name in a disk command, this query function will be disabled, and if there is room on the command line, the display "SUPPRESS QUERIES" will appear. This suppression is only effective for the individual command in which it is entended.

I.E. INIT DISK 0 SUPPRESS QUERIES

This command would suppress the SBA query "ERASE DISK?" and would initialize the disk in the zero drive when the carriage return key is pressed.

2. **Write Protect (W)** - This function is used for protecting disk files from further modifications. Entering a 'W' after a file name in a SAVE command write-protects that file. This protection is noticeable on a drive's directory page; a "W" is placed next to a file's block number indicating the file is protected. There is a command that will write-protect or unprotect a previously created file. The command is ASSIGN "FILENAME" = WRITE PROTECT or UNPROTECTED and is discussed later in this module. A PURGE command will erase a write-protected file if the operator correctly answers or programs the SUPPRESS QUERY function.

I.E. SAVE KEY RECORDS > "KEYRECRD.TST1" W

If the user tries to save an SBA mode to a write protected file, the display FILE "XXXXXXXXXXXX", WRITE PROTECTED will appear (X stands for the respective file name).

3. **Link (L)** - This command will link files together enabling multiple files or setups of the SBA to be linked under a single file name. Enter 'L' after the file name to link the information being saved to the file name entered. If a linked file is loaded, all of the linked modules of the file will be loaded, and there can not be similar modules within a file, that is, there can not be multiple operation modes saved within a single file.

I.E. SAVE OPER MODE > "0:SETUP.SYSTEM" L

This example would link or attach the current Operation Mode setup of the SBA to the exsisting file "SETUP.SYSTEM".

4. **Verify (V)** - This command will compare data read or written from disk to insure data integrity. Enter 'V' after a disk command to implement this function.

I.E. LOAD FROM "1:BCTEST.CNFIG1" V
SAVE OPER MODE > "0:OPSYSTEM.1" V

Mulitple functions may be entered on a disk operation, and the functions may be entered in any order. The example below illustrates an operation that links the SBA mode KEYRECORDS to an exsisting file: queries are suppressed, the file will be linked, verified and write protected.

i.e. SAVE KEYRECORDS > "SETUP#1_01-86" S L V W

SAVING FILES TO DISK

SBA modes or setups may be saved to disk providing a means of saving a setup and recalling it in the future (a list of SAVE commands appear at the end of this section). By using the SAVE command, the user may also save a file(s) from one disk to another. When the SBA has completed the requested SAVE, a display ***SAVE ACCEPTED*** will be shown on the CRT.

SAVING MODES OF THE SBA

1. Enter 'S' for SAVE.
2. Enter the first letter of the SBA mode which is to be saved. The full name of the mode will appear along with a > sign preceeding the target of the save.
3. Enter the desired file name (up to 13 characters). Remember to include beginning and ending double quotes (").
4. Enter a file function(s) if desired.
5. Enter carriage return. The SBA will inform the user that a SAVE function is occurring.

```
I.E.  SAVE KEYRECORDS > "TEST1.2" S
      SAVE OP MODE    > "1:SETUP1/3" S V
```

SAVING OR COPYING FILES FROM DISK TO DISK

1. Enter 'S' (for SAVE).
2. Enter the name for the file to be copied (end the name with double quotes "). A > will appear after the entered file name.
3. Enter the target drive's number (i.e. "1:" or "0:").
4. Enter a file function(s) if desired.
5. Enter carriage return.

```
I.E.  SAVE "BC_SETUP.EXE" > "1:"
      SAVE "BC_*" > "1:"          - Saves all files starting
                                    with BC_
      SAVE "1:RT_RT_SETUP" > "0:"
      SAVE "*" > "1:"             - Saves all files from zero
                                    drive to one drive.
```

SAVE COMMANDS

```
SAVE RS-232 > ""
SAVE GPIB > ""
SAVE OPER MODE > ""
SAVE STACK xxxx TO xxxx > ""        STACK ADDRESS IN DEC
SAVE HEADER > ""
SAVE KEYRECORDS > ""
```

```
SAVE XMIT BUFFERS > ""
SAVE DATA BUFFERS > ""
SAVE MEM xxxx TO xxxx > ""          MEM ADDRESS IN HEX
SAVE BACKGROUND ACTIVITY > ""
```

NOTE: Stack data can not be read from a disk file and placed back into the SBA's stack, but may be transferred to an I/O port (RS-232, GPIB, or LPT).

LOADING FILES FROM DISK

The loading of files from disk is easy, and the only prerequisite is knowing which file is to be loaded. Display the Directory page for the drive desired and select the file to be saved, then follow the directions below.

1. Enter 'L' for **LOAD FROM >**.
2. Enter the file name for the desired file (remember to start and end the file name with double quotes ").
3. Enter carriage return. The SBA will inform the user that a load function is occurring.

While the SBA is loading a file, the affected SBA addresses are displayed. Depending on the operation, the Operational Mode 1 page may be displayed following the load operation.

PURGING FILES

Purging a file erases it from the disk. The following steps will purge a desired file(s).

1. Enter 'P' for **PURGE.**
2. Enter the desired file name to be purged (erased). Remember to include the ending double qoute ("). The PURGE command automatically inserts the beginning double quote.
3. Enter the file function S (surpress queries) if you want to suppress queries on the operation.
4. Enter carriage return, and answer the query, ERASE FILE?, if the S option was not entered. Answer with a Y for YES or any other key for NO.

After the carriage return or query answer has been entered, the LED for the respective drive will light, indicating that the drive is in operation. However, if the query answer was no, the file will not be purged.

Also, remember that an astrisk may be inserted into the file name to purge files (maybe the entire disk) with similiar beginning characters. If the S option is not selected after the file name to be purged, the operator will be queried before the erasing of each

individual file.

i.e. PURGE "OPER_MODE.TST" - Erase file OPER_MODE.TST from drive zero. Will query.
PURGE "1:BC-TEST.1-86" SUPPRESS QUERIES - Erase file BC-TEST.1-86 from drive one. No query
PURGE "1:*" - Erases all files from drive one. Will query.

ASSIGNING WRITE-PROTECTION or UNPROTECTION

A file(s) may be write-protected or unprotected with the ASSIGN command of the SBA. Write-protecting a file will secure the file from future SAVE commands, and unprotecting a file will allow the file to be accessed by a SAVE command for overwriting or linking. The following steps will protect or unprotect a file(s).

1. Enter '**A**' for ASSIGN.
2. Enter the file name to be operated on. Remember to include beginning and ending double quotes ("). After the ending double quotes has been entered, an = will appear. Thus, we have so far ASSIGN "D:XXXXXXXXXXXXX" = , where D is the drive specifier (optional) and X represents a file name.
3. Enter the ASSIGN operation, either **W** for WRITE PROTECT or **U** for UN PROTECT.
4. Enter carriage return to execute the command.

Also, by using the wild card entry (*) anywhere in file name, similiar files or the entire drive may be operated on.

i.e. ASSIGN "1:TEST*" = WRITE PROTECT - Simliar files.
ASSIGN "1:*" = UN PROTECTED - All files on drive one.
ASSIGN "*" = WRITE PROTECT - All files on zero drive.

CHANGING FILE NAMES

File names of exsisting files may be altered with the CHANGE command. A file whose name is to be changed must have the new name on the same drive. File names can not be changed from drive to drive. To copy or change a file name when copying from one drive to another, use the SAVE command. In the event that the drive specifier is different in the CHANGE command, the drive specifier included in the new name will be ignored and the file name will be changed on the original drive . Follow the steps below to change a file name.

1. Enter C for CHANGE.
2. Enter the name for the file TO BE CHANGED. Be sure to

include the respective drive specifier and beginning and ending double quotes. When the ending double quote is entered the SBA will place a comma after the entered file name.

3. Enter the NEW name for the file. Again, include the repsective drive specifier and ending double quotes (the SBA automatically inserts the beginning double quotes).
4. Enter carriage return to execute the command.

i.e. CHANGE "1:OLD-NAME" , "1:NEW-NAME"

Helpful Hints

1. Try to use the zero drive when ever possible to avoid the need of entering the drive specifier.

2. If a COMMAND FAILURE message appears, an error has been made in a disk operation command.

3. If you think there is a file on a disk but the directory page does not show it, open and close the drive's door and re-display the directory.

4. Try to avoid the use of an underscore character because it is not displayed (but is present) on the Command Line, although it is present and will be displayed in the directory.

5. Try to keep file names as short as possible to avoid needless typing when specifying files to be loaded, etc.

MODULE 7 SBA INTERFACING

The SBA has eight interface capabilities. Data can be transferred via RS-232, IEEE-488, High Speed Parallel, Line Printer, Event Trigger, Transmit (XMIT) Disable, and Composite Video. There is also a coaxial port for an external noise gate (see Module 8). The SBA may be controlled from an external device over RS-232 or IEEE-488 lines. The pin-outs for the RS-232 and line printer ports are given at the end of this module.

High Speed Parallel

The High Speed Parallel output allows continuous monitoring of the 1553 bus. The SBA outputs 50 KHZ bursts of bus data (one word every 20 uSEC), according to the message format, over a 37-pin Winchester port.

Line Printer

The Line Printer is a Centronics interface with a 25-pin connector.

Event Trigger and Transmit Disable

The Event Trigger and Transmit Disable are coaxial connectors. The Event trigger operates at TTL levels from low to high. The Transmit Disable engages at ground.

Composite Video

The Composite Video operates at 19.8 KHZ (horizontal frequency).

THESE LAST THREE INTERFACES ARE DISCUSSED IN GREATER DETAIL IN THE USERS MANUAL.

External Control

An external device may control the SBA over the RS-232 and IEEE-488 lines with proper word formatting and SBA assign commands. Word formatting is discussed in section 4 of the users manual, and assign commands are covered in Module 9 of this text.

Loading Data from RS-232 or IEEE-488

To load data perform the following:

1. Assure proper formatting. (See section 4. of the Users Manual)
2. Connect the external device to the desired port of the SBA.
3. Program the I/O page for parameter definition.
4. Enter the desired load command: 'LR' [62] for "LOAD FROM RS-232;" or 'LG' [61] for "LOAD FROM GPIB."

Saving Data over RS-232 or IEEE-488

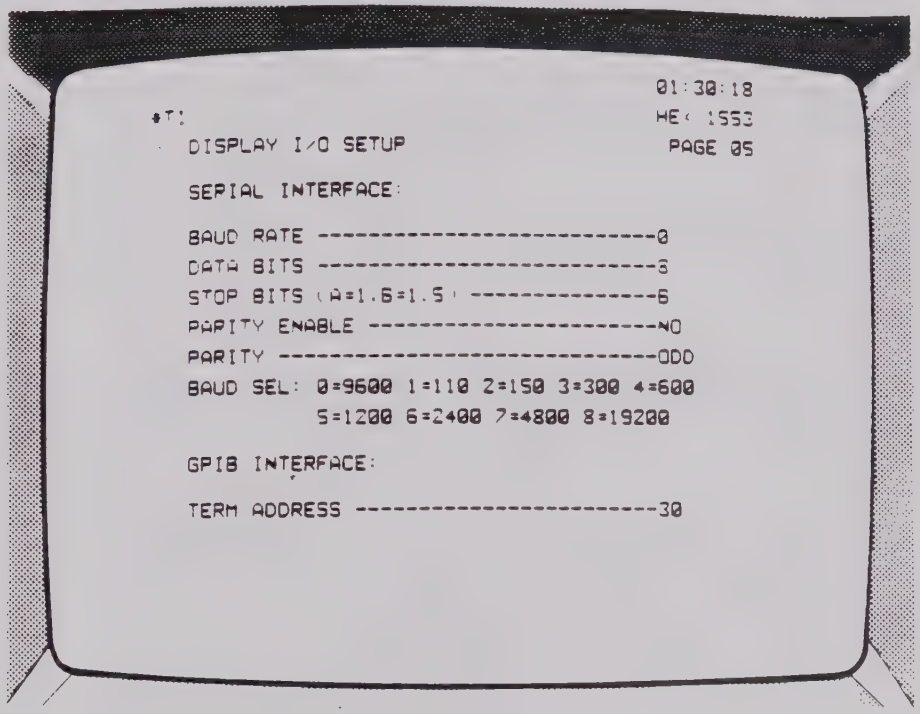
To save data over these lines perform the following:

1. Assure format acceptability to external device.
2. Connect the external device to the desired port of the SBA.
3. Program the I/O page for parameter definition.
4. Enter the desired save command.

For more information on the GPIB or RS-232 interface, call an Application Engineer at Loral.

I/O Page

The I/O page configures the SBA for RS-232 and IEEE-488 interfaces. There is only one parameter that requires defining on the I/O page for IEEE-488 transmissions -- IEEE-488 terminal address. At the bottom of the page enter any numeral from 0-31 for the SBA's IEEE-488 terminal address. <Default = 0>



TO DISPLAY THIS PAGE ENTER **'DI' [D5].**

If transmitting over RS-232, the following parameters should be programed.

Baud Rate -- This variable sets the transmission rate in bits/sec. The choices are listed below the serial interface paragraph. Enter the corresponding numeral for the desired speed. <Default = 0>

Data Bits -- This variable selects the length of each data byte. There are four options: '5', '6', '7', '8'. This does not include parity or stop bits. <Default = 0>

Stop Bits -- This variable selects the stop bit length for RS-232 interface. The bit length options are: 'A' = 1 stop bit and 'B' = 1.5 stop bits. <Default = A>

Parity Enable -- This variable causes a parity to be generated if a 'Y' [1] is entered on this line. If an 'N' [0] is entered, then no parity is generated. <Default = 0>

Parity Selection -- If a parity is to be generated for RS-232 interfacing, enter 'O' [0] for odd parity. To select even parity, enter 'E.' If the parity function is disabled this variable is ignored. <Default = 0>

PIN OUTS FOR REAR-PANEL

RS-232 (PIN CONNECTIONS NOT TO EIA STANDARDS)

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	GND	11	NC	21	NC
2	RX DATA	12	NC	22	NC
3	TX DATA	13	NC	23	TX RET
4	CTS	14	NC	24	RX RET
5	RTS	15	NC	25	GND
6	DTR	16	NC		
7	GND	17	NC		
8	NC	18	NC		
9	NC	19	NC		
10	NC	20	DSR		

IEEE 488

PIN	FUNCTION	PIN	FUNCTION
1	D1Ø1	12	GND
2	D1Ø5	13	NRFD
3	D1Ø2	14	GND
4	D1Ø6	15	NDAC
5	D1Ø3	16	TGND
6	D1Ø7	17	IFC
7	D1Ø4	18	GND
8	D1Ø8	19	SRQ
9	EOI	20	GND
10	REN	21	ATN
11	Day		

LINE PRINTER

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	DØ	9	NC	17	S2 - Busy
2	D1	10	NC	18	NC
3	D2	11	NC	19	C2
4	D3	12	NC	20	NC
5	D4	13	NC	21	S3
6	D5	14	C1 - Strobe	22	S4
7	D6	15	Blank	23	NC
8	D7	16	S1	24	NC
				25	GND

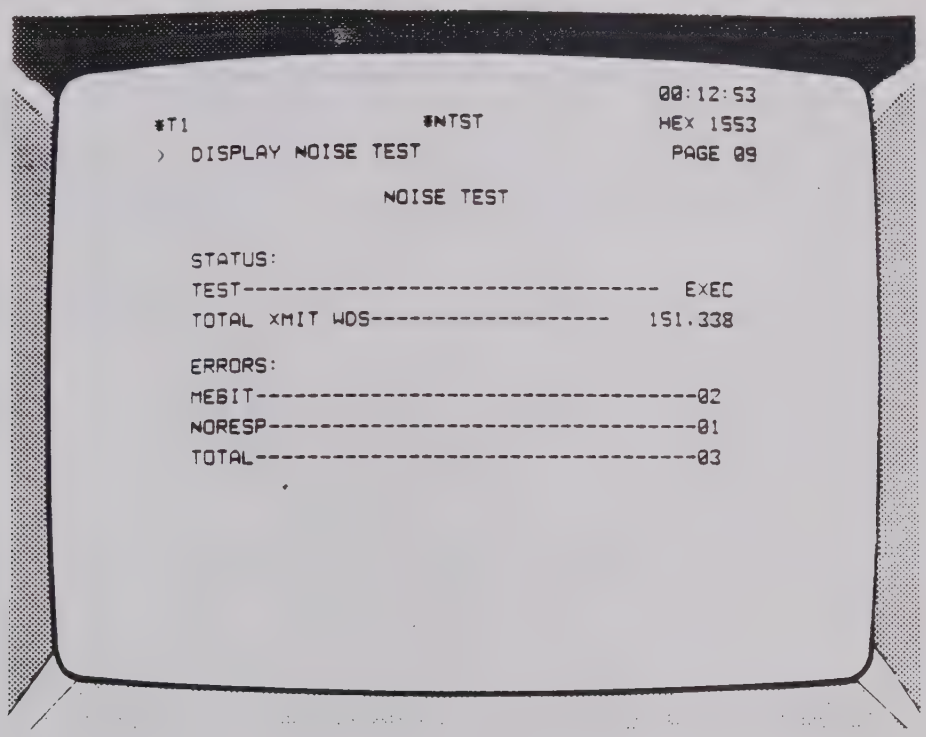
The Noise Gate, Event Trigger and Xmit Disable are standard BNC, Part No. M39012/16-001. Threaded jack screws are used to fasten the multi-pin connection.

MODULE 8 SBA RT NOISE TEST

The noise immunity test provides a means for obtaining the word to error ratio of a terminal's receiver in the presence of white gaussian noise. The status and results of the test are displayed on the Noise Test Page of the SBA. To perform this test efficiently, the operator must adjust transmission timing and electrical requirements of the SBA to match those of the external bus.

Timing adjustments are made on the BC and Frame Format Pages and the electrical characteristics are adjusted on the Operation Mode 1 Page.

The SBA can finish a noise test in 15 to 30 minutes with proper timing adjustments (an oscilloscope aids in transmission).



TO DISPLAY THE NOISE TEST PAGE ENTER 'DN' [D9].

The following three sections explain the Noise Test page.

Test -- This line shows one of four conditions of the test:

Execution - This is displayed while the test is being executed.

Pass - This is displayed when the external bus has passed the test criteria.

Fail - This is displayed when the external bus has failed the test criteria.

Halt - This is displayed when the test has been terminated.

Total Words Transmitted -- This line shows the total number of words transmitted. This value is determined by the word count field of the transmitting BC command word and the number of times the command is transmitted. This display is dynamically updated during the execution of the test.

Error Section -- The three lines of the error section show a breakdown of the errors detected by the SBA during the test.

Message Error (MEBIT) - This line shows the number of status words with the message bit set.

No Response (NORESP) - This line display the number of no responses detected by the SBA.

Total Errors - This line shows the total number of Mebit and Noresp errors detected.

Executing a Noise Test

To execute a noise test perform the following:

1. Connect the external bus to the 1553 port of the SBA.

2. Connect the noise generator to the appropriate point on the bus system (stub connecting the RT to the bus).

3. Connect the noise gate output port of the SBA to the gate output on the noise source.

4. Setup the Operation Mode 1 Page to match the external bus's electrical conditions and select the RANDOM (RAND) function.

5. Setup BC page 01. The gap time should be set (allow for the RT's response). The SBA RESPONSE selection should be set to NO, and a "NOISE GATE" error entered on the "ERROR:" line. The entire function line should have 1's entered.

6. The Frame Format must be set to transmit BC page 01 only, and the Minor Frame time should be as tight as possible.

7. TO EXECUTE THE NOISE TEST ENTER 'EN' [E2].

NOTE: AT LEAST 44 MILLION WORDS ARE NEEDED TO BE TRANSMITTED FOR A COMPLETE TEST.

MODULE 9 MISCELLANEOUS FUNCTIONS

GOSUB Programing

SEE APPENDIX B.

Filling Memory Data Blocks

To fill a memory data block with a specified value, enter 'FMxxxx,yyyy zzzz' [F1xxxx,yyyy zzzz] where xxx represents the starting address, yyyy represents the ending address, and zzzz represents the value to be entered.

Memory Test

A memory test compares the content of specified address to a specified data word value or ASCII string. To compare a memory content enter 'TMxxxx,yyyy' [21xxxx,yyyy] where xxxx represents the memory address and yyyy represents the value for comparison. The result of the comparison will set the TRUE/NOT TRUE flag. If the compared values are identical, the TRUE flag is set. If the compared values are not the same, the NOT TRUE flag is set.

System Test

The SBA has the capabilities of self-test with internal diagnostics; enter 'TS' [20] for system test. This test resets all systems memory and programing varaibles to default values. During the test, the CRT displays "SBA 100 SYSTEM TEST XYY" where X represents the alpha version and YY represents the numeric version of the system's software. If there are any systems failures, the board causing the failure will be displayed. If there are no failures, the Operation Mode 1 page will appear. In case of failures call Loral Instrumentation's Customer Service at 1-800-854-1036.

Assign Commands

Assign Control x - Enter 'ACx' where x represents either IEEE-488 (GPIB) 'G' [3], RS-232 'R' [2], SBA 'S' [1] or Tape 'T' [0]. When control has been assigned to an external device, the SBA will respond to commands from the device. While the SBA is being controlled by an external device, the keyboard and keypad are locked. This condition remains until control has been assigned back to the SBA.

Assign Line Printer Control - This command assigns line printer control to a selected SBA interface; enter 'ALx' where x represents the desired interface: 'T' [0] for tape; 'R' [2] for RS-232; 'G' for GPIB; and 'C' for centronix. The desired interface is entered after the current status has been shown. This command display will show the current assigned interface. The form of data output from the SBA is ASCII. i.e. The system has had the Line Printer Port assigned to the RS-232 port. The output from the RS-232 port will be in ASCII when a save command to the Line Printer is executed. <Default = C>

Assign Display Base x - Enter 'ADx' where x represents the type of display base for SBA numeric displays. The choices for display are: 'B' for binary; 'D' for decimal; 'H' for hex; and 'O' [3] for octal. Not all displays are affected by base changes, but all numeric displays are available in HEX.

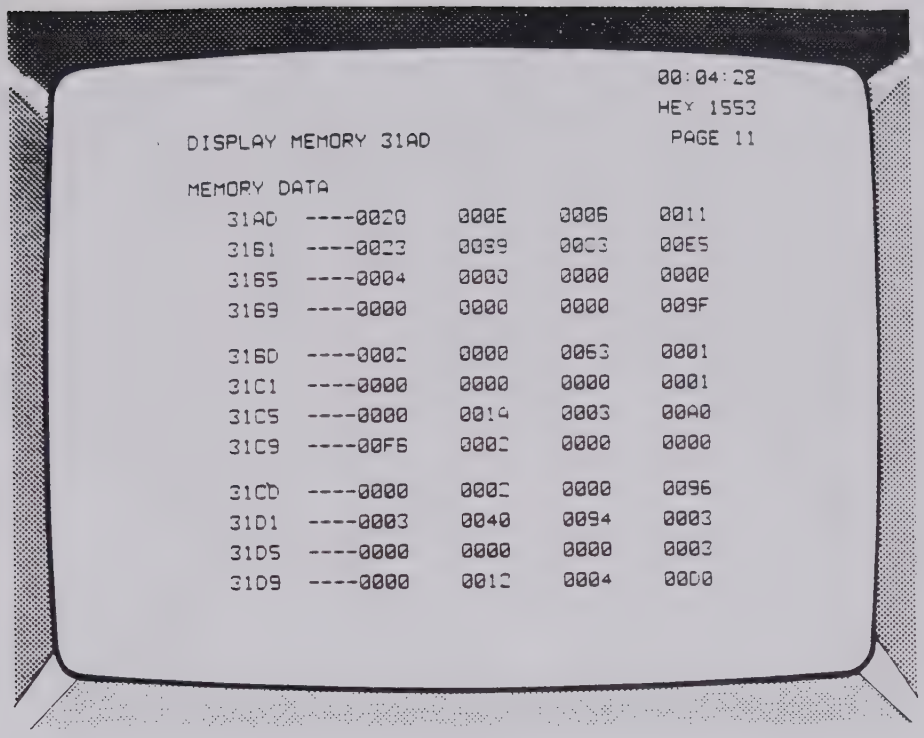
Change Time

The clock may be changed by entering 'CTxx:xx:xx,yy:yy:yy' [COxx:xx:xx,yy:yy:yy] where xx represents the old time and yy the new time to be entered.

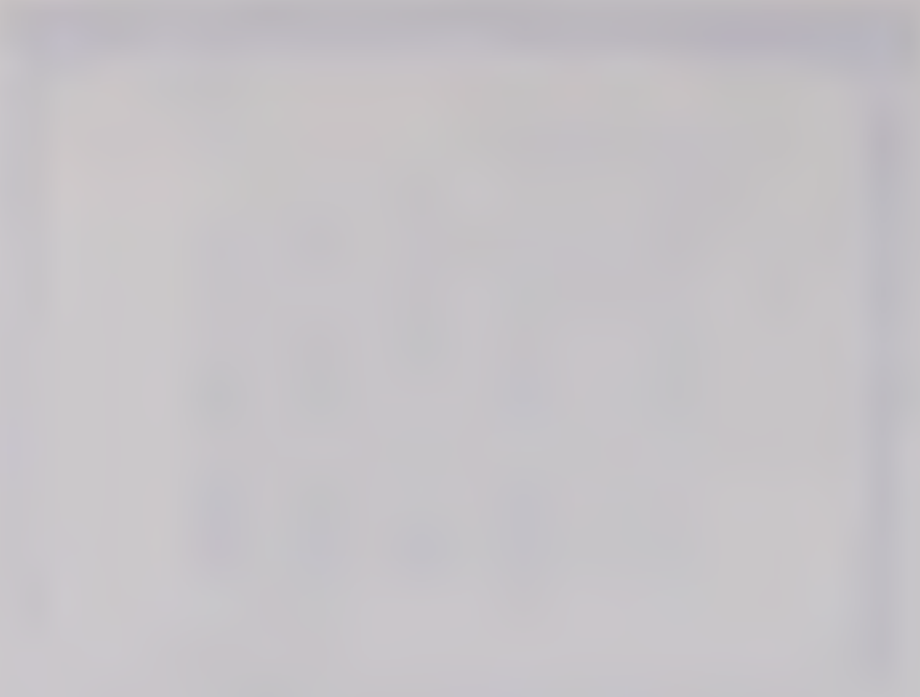
Command Key Functions

The following is a list of external keyboard command functions:

CTRL B = Rewinds the tape to the first file.
CTRL E = Rewinds and ejects the tape.
CTRL L = Locks the keyboard and keypad.
CTRL R = SBA software reset.
CTRL U = Unlocks the keyboard and keypad.



To display a block of 32 memory words enter 'DMxxxx' [DAxxxx] where xxxx represents the memory address.



APPENDIX A

GLOSSARY OF TERMS

1553

Military standard that establishes the requirement for digital, command/response time-division multiplexing techniques on aircraft. In the SBA User's Manual, 1553 is used as a generic name for MIL- STD-1553 (USAF), MIL-STD-1553A, and MIL-STD-1553B. Where a specific revision is referenced, the revision suffix is added: e.g., 1553B.

A

Aperiodic

Events occurring at indefinite or unscheduled time periods. This term is used to describe the timing of messages that are not assigned a regular transmission update rate. "Asynchronous" is another word used to express the same condition.

Applications Software

Those programs whose purpose is dedicated to specific function (e.g., navigation, fire control, I/O conversion). This distinguishes applications software from executive software.

Architecture

The functional structure of a multiplex system as defined by the physical interconnection (topology) and the mutiplex system control. See "Configuration."

Asynchronous

Without timing regularity, asynchronous operation per 1553B is: "For the purpose of the standard, asynchronous operation is the use of an independent clock

source in each terminal for message transmission. Decoding is achieved in receiving terminals using clock information derived from the message." See "Aperiodic."

Asynchronous Operation

For the purpose of the standard, asynchronous operation is the use of an independent clock source in each terminal for message transmission. Decoding is achieved in receiving terminals using clock information derived from the message.

Avionics

All electronic and electromechanical systems and subsystems (hardware and software) installed in an aircraft or attached to it.

B

Bit

Contraction of binary digit. May be either zero or one. In information theory, a binary digit is equal to one binary decision or the designation of one of two possible values or states of anything used to store or convey information.

Bit Rate

The number of bits transmitted per second.

Broadcast

Operation of a data bus system such that information transmitted by the bus controller or a remote terminal is addressed to more than one of the remote terminals connected to the data bus.

Built-in Test (BIT)

The capability of a line replaceable unit (LRU) to perform some form of self-test.

Bus

In this manual (unless otherwise noted in the text), bus refers to 1553 data bus. See "Data Bus."

Bus Controller

The terminal assigned the task of initiating information transfers on the data bus. Note that an "information transfer" is a format that includes transmission and response by the appropriate terminal.

Bus Interface Unit (BIU) Function

This term is generally interchangeable with "terminal" as defined in 1553B: "The electronic module necessary to interface the data bus with the subsystem and the subsystem with the data bus. Terminals may exist as separate line replaceable units (LRUs) or be contained within the elements of the subsystem."

Bus Interface Unit (BIU) Hardware

This term describes a particular set of hardware that performs the interface between the data bus and the internal portion of an embedded or stand-alone remote terminal. At a minimum, it refers to the digital decode and encode logic that expands to the complete analog-to-digital interface between the data bus and the internal remote terminal electronics or the subsystem for embedded terminals.

Bus Monitor

The terminal assigned the task of receiving bus traffic and extracting selected information to be used at a later time.

C

Command/Response

Operation of a data bus system such that remote terminals receive and transmit data only when commanded to do so by the bus controller.

Communications Protocol (Protocol)

The conventions imposed on serial data to ensure that the receiver correctly interprets the transmitted data; also, the procedures used for initiating messages and responding to them.

Configuration

The specific functional structure of a given integrated system consisting of physical interconnection (topology) and system control. See "Architecture."

D

Data

This term is used in this handbook to denote the content (16 bits) of information transferred on the 1553 data bus in one data word.

Data Bus

Whenever a data bus or bus is referenced in this manual, it implies all the hardware, including twisted-shielded pair cables, isolation resistors, transformers, etc., required to provide a single data path between the bus controller and all the associated remote terminals.

Direct Coupled

A method of connecting terminals to the 1553 data bus using only a wire splice.

Dynamic Bus Control

The operation of a data bus system in which designated terminals are offered control of the data bus.

E

Embedded Interface

The 1553 interface circuitry housed within a subsystem.

Error Recovery

General term used to describe the detection of transients or hard failures and the step-by-step sequence to branch to alternate functions, procedures, or equipment use.

Event

A single occurrence at a precise time.

F

Function

The special work done by a subsystem or a software task.

H

Half Duplex

Operation of a data transfer system in either direction over a single line but not in both directions on that line simultaneously.

Hierarchical Control

A form of distributing all control in a system, whereby one level of control is subordinate to a higher level of control.

I

Input-Output (I/O)

This term is used to describe both the activity in which hardware and software receive and transmit data and the physical section of hardware that is the interface between the 1553 and the subsystems of a remote terminal or bus controller.

Integration

In this handbook, integration refers to the cooperative need for shared information and the means for achieving that cooperation.

M

Major Cycle

A period of scheduled time during which all periodic transmissions and computations occur at least once. Major cycles are divided into subcycles called minor cycles. See "Minor Cycle."

Message

In 1553 terms, a message is a part of an information transfer format, such as 1 to 32 data words. A message may also refer to the entire transmission by both bus controller and responding remote terminal, which includes not only the data words but the overhead. This second usage is more correctly called an information transfer format.

Definition from 1553: "A single message is the transmission of a command word, status word, and data words if they are specified. For the case of a remote terminal-to-remote transmission (RT-to-RT), the message shall include the two command words, the two status words, and data words."

Minor Cycle

A period of scheduled time during which the most frequently occurring periodic transmission or computation will occur, or a period scheduled for a frequently occurring transmission or computation. Multiple minor cycles may be required to achieve a major cycle. See "Major Cycle."

Mode Code

A means by which the bus controller can communicate with the multiplex bus-related hardware to assist management with the information flow.

Modem

In this manual, this term is used to mean the analog transceiver circuitry used to convert data to digital form. It is also used to denote a bus interface unit function.

Modulation

The signaling method used to convey data on the data bus.

Multiplexing

The transmission of information from several signal sources through one communication system.

P

Partitioning

The method used to divide a coplex system or function into manageable size before allocating these smaller pieces to devices to perform the required job.

Periodic

Event(s) recurring at specific time intervals. See "Aperiodic."

Protocol

The conventions imposed on serial data to ensure that the receiver correctly interprets the transmitted data; also, the procedures used for initiating messages and responding to them. See "Communications Protocol."

R

Redundant Data Bus

The use of more than one data bus to provide more than one data path between the subsystems (i.e., dual-redundant data bus and tri-redundant data bus).

Redundancy

The method of replicating a function for the purpose of increasing the availability of the function.

Remote Terminal (RT)

All terminals not operating as the bus controller or as a bus monitor.

Retrofitting

The process of updating a system with new or modernized equipment.

S

Sensor

The hardware and software required to perform a specific avionic function.

Specification

A document prepared specifically to support procurement that clearly and accurately describes the essential technical requirements for purchased material. Also included are procedures necessary to determine that the requirements have been met for the purchased material covered by the document.

Standard

A military standard is a document that establishes engineering and technical requirements for processes, procedures, practices, and methods that have been adopted as standard.

Stub

The electrical interface between the data bus and the terminal.

Subsystem

The hardware and software required to perform a specific avionic function. See "Sensor."

Definition from 1553: "The device or functional unit receiving data transfer service from the data bus."

Synchronous

Events occurring at specific time intervals. See "Aperiodic."

System

The collection of subsystem equipment required to perform a specific mission or job.

System Control

The local control of each of the data bus elements as well as the coordination of this control to perform an orderly functioning system.

T

Terminal

The electronic module necessary to interface the data bus with the subsystem and the subsystem with the data bus. Terminals may exist as separate LRUs or be contained within the elements of the subsystem.

Time Division Multiplexing (TDM)

The transmission of information from several signal sources through one communication system with different signal samples staggered in time to form a composite pulse train.

Topology

The interconnectivity of the data bus(es) and their associated elements (terminals and controllers) to accomplish the desired data path required by the integration.

Transformer Coupled

A method of stubbing to the 1553 data bus that uses a transformer and isolation resistors.

W

Word

A 1553 word is a sequence of 20 bit times consisting of a 3 bit-time sync, 16 bits of data, and 1 parity bit. This is the word as it is transmitted on the bus: 1553 terminals add the sync and parity before transmission and remove them during reception. Therefore, the nominal word size is 16 bits, with the most significant bit first. There are three types of words: command, status, and data.

Definition from 1553B: "In this document, a word is a sequence of 16 bits plus sync and parity. There are threee types of words: command, status, and data."

GOSUB
XXXX

G(OSUB) nnnn @

nnnn: Starting address of a Gosub routine
@ < RET> . < CR>

PURPOSE.

This command transfer execution from SBA system software to an operator- written routine located at address nnnn. This routine may be entered into the SBA using the CHANGE MEMORY command, or it may be transferred to the SBA by a host computer using either RS-232 or GPIB. The operator routine must end with an 8080 RETURN INSTRUCTION. All 8080 registers with the exception of the stack pointer may be corrupted without disturbing the system software.

COMMAND

G(OSUB) 7000 < RET>

ACTION: The SBA provides operator RAM beginning at address 514EH and extending to address 7800H. This area can be used for keyrecord storage or machine language routines or both. When keyrecords are entered into the SBA they are placed into the buffer beginning at 514EH. Each keyrecord is placed at progressively higher RAM locations until the buffer is full. Most applications, however, do not use the full buffer and allow room at the top of keyrecord storage for a machine language routine to be placed. Having both keyrecords and machine language routines in the buffer at the same time provides a powerful combination, allowing the operator to perform most of his task using the high level command set of the SBA, and allowing normally non-supported functions to be performed using the GOSUB command from the keyrecords. It is recommended that machine language routines be located at address 7000H and above.

Two examples are provided in this description to demonstrate the power of the GOSUB command. In the first example the routine enhances the capabilities of the SBA by significant reduction in execution time to set up BUS controller function parameters. In the second example the routine adds to the capabilities of the SBA to perform limit checks on specific data words being received and takes appropriate action as defined by the operator.

EXAMPLE #1

The following routine (Exhibit GOSUB #1) will change all 32 of the BC pages to the secondary bus using a single GOSUB command. To execute this routine, enter it into the SBA using any of the methods described previously (NOTE: This routine is written for execution in the SBA software version specified in GOSUB #1 only.) Then execute the GOSUB 7000 command either from the command line or a keyrecord. A memory display of this routine is shown in Exhibit GOSUB #5.

EXHIBIT GOSUB #1

8080

```
0000                    ORG   X'7000'
                        The following equates apply to version E22 only

4CB1          BUSSEL    EQU   X'4CB1'
00F9          MCBBX     EQU   X'00EF'
48D2          BCNUM     EQU   X'49D2'

7000 21B14C   SEC32     LXI   H,BUSSEL    Start of BC records
7003 111000             LXI   D,16        Length of a BC record
7006 0601               MVI   B,1         INIT loop counter
7008 78       SEC321    MOV   A,B         Pass BC number
7009 32D248             STA   BCNUM       To subroutine
700C 3E40               MVI   A,X'40'     Set field to secondary
700E 77                 MOV   M,A
700F CDF900             CALL  MCBBX       Program the bit slice
7012 19                 DAD   D           Move to next BC
7013 04                 INR   B           Adjust loop counter
7014 78                 MOV   A,B
7015 FE21               CPI   33          Exit if done
7017 CB                 RZ
7018 C30870             JMP   SEC321      Otherwise do another BC
701B                    END   SEC32
```

EXAMPLE #2:

The following routine (Exhibit GOSUB #3) together with the keyrecord sequence shown (Exhibit GOSUB #2) will capture a message from RT 01 subaddress 02, then check to see if data word #5 is within the limits passed by the keyrecords. These limits have been arbitrarily chosen to be 7 for the low limit and 9 for the high limit. If the word is within limits, the keyrecord sequence is started over. If it is not within limits, a branch is made to keyrecord 10 and the sequence terminates. A memory display of this routine is shown in Exhibit GOSUB #6. (NOTE: This routine is written for execution in the SBA software version specified in GOSUB #3 only.)

EXHIBIT GOSUB #2

Keyrecord Sequence

	01:52:41
	HEX 1553
DISPLAY KEYRECORD 1	KEY 001
DISPLAY CAPTURE	See EXHIBIT GOSUB #4 for this setup
CHANGE MEM 7300 = 0000 7	Pass low limit to subroutine
CHANGE MEM 7302 = 0000 9	Pass high limit to subroutine
RUN STACK	Run stack and wait till full
WAIT STACK FULL	
DISPLAY STACK 1	DISPLAY STACK
MOVE STACK 0001, 0010 INTO MEMO 7000	Then move it to memory
GOSUB 7304	See if within limits
EXECUTE JUMP TO KEY 010 IF NOT TRUE	Exits here if not
EXECUTE KEYRECORD 1	Start over if it is

EXHIBIT GOSUB #3

```
                                    8080

0000            ORG     X'7300'

                        The following equates apply to version E22 only

4091            TRUFLG  EQU     X'4091'     True-False flag for SBA
0598            CMPHD   EQU     X'0598'     Compare (HL) to (DE)
0005            WORD    EQU     5           Data word to check

7300 0000       LOW     DW      0           Low limit from keyrec.
7302 0000       HIGH    DW      0           High Limit from keyrec.

7304 210c70     CHKSTKW LXI     H,X'7002'+2*WORD  HL point to data word
7307 5E                 MOV     E,M         Get LSB of word
7308 23                 INX     H           Bump to MSB
7309 56                 MOV     D,M         Get MSB
730A 2A0073             LHLD    LOW         Get low limit
730D CD9805             CALL    CMPHD       Compare the two
7310 DA2273             JC      BADEX       Word is too low
7313 2A0273             LHLD    HIGH        Get high limit
7316 23                 INX     H           Adjust for compare
7317 CD9805             CALL    CMPHD       Compare the two
731A D22273             JNC     BADEX       Word is too high
731D AF                 XRA     A           Clear A
731E 329140             STA     TRFLG       Set TRUFLG to true
7321 C9                 RET
7322 3E55       BADEX   MVI     A,X'55'     Set TRUFLG to false
7324 329140             STA     TRUFLG
7327 C9                 RET

7328            END     CHKSTKW
```

EXHIBIT GOSUB #4

```
                              01:34:47
                              HEX 1553
DISPLAY CAPTURE

TRIG MODE=START
TRIG LINK-T1 ARM T2 or T3 or T4
TRIG ENA BUS  ERROR    VALUE
T1   YES BTH =         =C01 T 02 10
T2   YES BTH =         =S01 X XX XX
T3   NO  BTH =         =CXX X XX XX
T4   NO  BTH =         =CXX X XX XX

CAPT MODE-ALL

MESG ENA BUS  ERROR    VALUE
M1   NO  BTH =         =CXX X XX XX
M2   NO  BTH =         =CXX X XX XX
M3   NO  BTH =         =CXX X XX XX
M4   NO  BTH =         =CXX X XX XX
```

EXHIBIT GOSUB #5

00:02:07
HEX 1553
Page 11

DISPLAY MEMORY 7000

MEMORY DATA				
7000	----0021	00B1	004C	0011
7004	----0010	0000	0006	0001
7008	----0078	0032	00D2	0048
700C	----003E	0040	0077	00CD
7010	----00F9	0000	0019	0004
7014	----0078	00FE	0021	00C8
7018	----00C3	0008	0070	0000
701C	----0000	0000	0000	0000
7020	----0000	0000	0000	0000
7024	----0000	0000	0000	0000
7028	----0000	0000	0000	0000
702C	----0000	0000	0000	0000

EXHIBIT GOSUB #6

17:46:02
HEX 1553
Page 11

DISPLAY MEMORY 7300

MEMORY DATA:

7300	----0000	0000	0000	0000
7304	----0021	000C	0070	005E
7308	----0023	0056	002A	0000
730C	----0073	00CD	0098	0005
7310	----00DA	0022	0073	002A
7314	----0002	0073	0023	00CD
7318	----0098	0005	00D2	0022
731C	----0073	00AF	0032	0091
7320	----0040	00CD	003E	0055
7324	----0032	0091	0040	00C9
7328	----0000	0000	0000	0000
732C	----0000	0000	0000	0000

The following stand alone exercises are designed to introduce the user to SBA functions. There are three exercises. The first exercise has the user con- figure two BC messages to which RTs will respond. The second exercise has the user configure two BC messages, one containing an error, and two RT responses. Finally, the third exercise has the user configure five BC messages: The first two will contain errors; the third and fourth will configure an RT-to-RT transfer; and the fifth will contain a mode command. The user will be asked to perform these three tasks without any support, but a step-by-step procedure is provided in case the user is unable to complete the task being performed (page displays figures showing the correct variable values are also provided). All entries are made from the external keyboard.

ENTRY REVIEW

All commands that display SBA pages are executed with a carriage return. Once a page has been displayed and in-page variables are to be set, use the arrows to change the cursor position. Only enter the carriage return when all variable entries have been made on a given page and the cursor will return to the command line (the up arrow also returns the cursor to the command line).

TASK 1

Set up two SBA generated BC messages and appropriate RT responses, and display the bus traffic on the Terminal page. Use BC 01 and 02 pages , and RT 01 and 02 pages (RT addresses will be 01 and 06, respectively). The Terminal page should appear like Figure 1, but the CMDS column will display increasing counts for the two messages shown.

```
                                                    00:01:22
<<<                                                 HEX 1553
>  SAVE CRT TO LPT _                                 PAGE 02
   TERM     SUB    WC     BUS CMDS   ERRS    ERRORS
   ********************************************
   01     R 01     01     PRI 01050 00000         *
   ***************************************        *
   06     R 01     01     PRI 01052 00000*        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *
                                         *        *

   TOTAL ERRORS-              0
```

Figure 1. Terminal page

SOLUTION TO TASK 1

Perform the following to transmit two BC messages and two RT responses. (The Oper Mode 1 and 2 and BC 01 pages default to the proper settings--See Figures i, ii, and iii).

1. Display and enable RT 01 page. Enter DR01 to display this page. On the ENAB line enter Y for YES. This enables this RT page to respond to a BC message. All other parameters on this page (only RT page 01) default to the proper settings for receiving the message set up that defaults on BC page 01. See Figure 5.

2. Display and set up the BC 02 page. To display this page, enter DB02. The command word and SBA RESPONSE (YES or NO) must be entered. See Figure 6.

   (A) On the CMD WORD line enter this format: C06 R 01 01.

   (B) On the SBA RESPONSE line enter Y for YES. This tells the SBA that the response to this BC message will be coming from an RT simulated within the SBA, and the SBA applies the GAP TIME after the RT's response.

3. Display and enable RT 02 page. Enter DR02 to display this page. Perform the following to set up this RT page to respond to the message set up on the BC 02 page. See Figure 7.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command word as entered on BC 02 page (C06 R 01 01), or enter C06 R XX XX. Entering XX,(don't cares), in the subaddress and word count fields will make this RT page respond to all receive commands sent to address 06.

   (C) On the STATUS WORD line enter the same terminal address as in the RESP CMD (S06 0 00 00).

4. Display and set up the Frame Format page. Enter DF to display this page. On the SBA's command line, enter CF001 for CHANGE FRAME 001. The symbol entered in slot 001 will be displayed when this command is entered. Immediately enter 02 and carriage return. This will add the BC 02 message to the transmit sequence which this page sets. See Figure 8.

5. Start transmission of the messages by entering XF for XMIT FOREVER.

6. To display bus activity, enter DT for DISPLAY TERMINAL. The INCR and DECR keys scroll the commands shown on this page up and down, changing the uppermost command shown between the horizontal lines at the top of the page. See Figure 1.

7. When finished with this exercise, enter TS for for TEST SYSTEM to reset all SBA parameters to the initialization values before starting the next exercise.

TASK 2

Set up two BC messages and appropriate RT responses, with one message containing a parity error that ripples through the RT response message on successive repetitions and display the captured messages on the Terminal page. Capture repetitions of second message only and display them on the Stack page. Use BC 01 and 02 pages and RT 01 and 02 pages (RT addresses are 01 and 04, respectively). The Terminal page will appear similar to Figure 1, but the second message will have a different address (04 instead of 06), the T/R bit will be set to T, and the page will show that there are errors occurring in this message. The Stack page should appear like Figure 2, but the times (displayed in microseconds) may vary somewhat from those shown here. Use the INCR key to scroll the stack display and see how the error ripples through the message on successive repetitions.

```
*T1                    *FULL                          01:27:29
> SAVE CRT TO LPT                                     HEX 1553
                                                       PAGE 12

   ADDR BUS  ERRORS WN   STACK DATA

      1                          5,539,128 USEC
T     2 PRI          0   C04 T 01 04
      3 PRI  PARITY  0   S04 0 00 00
      4 PRI          1   D0000
      5 PRI          2   D0001
      6 PRI          3   D0002
      7 PRI          4   D0003
      8                         10,016 USEC
      9 PRI          0   C04 1 01 04
     10 PRI          0   S04 0 00 00
     11 PRI  PARITY  1   D0000
     12 PRI          2   D0001

START
```

Figure 2. Stack page

SOLUTION TO TASK 2

This task is practically the same as 1. but this time there is to be an error in the RT response on the second message and this message will be selected from the bus traffic for display on the Stack page. Perform the following procedure to set up, capture, and display this message.

1. Display and enable the RT 01 page. Enter DR01 to display this page. On the ENAB line enter Y for YES. See Figure 5.

2. Display and set BC 02 page. Enter DB02 to display this page. Perform the following to set up this page. See Figure 9.

   (A) On the CMD WORD line enter the command C04 T 01 04.

   (B) On the SBA RESPONSE line enter Y for YES.

3. Display and set up RT 02 page. Enter DR02 to display this page. Perform the following to set up this page. See Figure 10.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command from the BC 02 page, C04 T 01 04. (C04 T XX XX could also have been used).

   (C) On the STATUS WORD line enter the same terminal address as in the RESP CMD. S04 0 00 00.

   (D) On the ERROR line enter PR, which is the keystroke code for PARITY, Ripple thru message. This will cause a parity error to appear in the RT response, rippling to the next successive word each time the RT responds.

4. Display and setup the Capture page. Enter DC to display this page. Perform the following to define the message to be captured. See Figure 11.

   (A) On the T1 line, under VALUE enter the command from the BC 02 message.
   (C04 T 01 04, or alternatively, C04 T XX XX could be used).

   (B) On the CAPT MODE line enter O for ONLY. This tells the stack to capture only the message specified on the M1 line.

   (C) On the M1 line, under the ENA column, enter Y for YES. This enables message trigger M1.

   (D) On the M1 line, under the VALUE column, enter the same command as in the VALUE column of the T1 line.

5. Display and set up the Frame Format page. Enter DF to display this page. On the SBA's command line, enter CF001 for CHANGE FRAME 001. The symbol entered in slot "001" will be displayed when this command is entered. Immediately enter 02 and carriage return. This will add the BC 02 message to the transmit sequence which this page sets. See Figure 8.

6. Start transmission of the messages by entering XF for XMIT FOREVER.

7. To display bus activity, enter DT for DISPLAY TERMINAL. The INCR and DECR keys scroll the commands shown on this page up and down, changing the uppermost command shown between the horizontal line at the top of the page.

8. To initiate selective activity monitoring enter R for RUN STACK. The CRT will display S RUN while filling the stack and S FULL when complete.

9. To display the stack at the starting address, enter DS1 for Display Stack 1 (1 is the addressed). The INCR and DECR keys may be used to scroll the stack display up and down. See Figure 2.

10. When finished with this exercise enter TS for TEST SYSTEM to reset all SBA parameters to the initialization values before starting the next exercise.

TASK 3

Set up five BC messages with the first and second containing an error, the third and fourth configuring a RT-to-RT transfer, and the fifth configuring a mode command. Display the messages on the Terminal page. Also, the first, third, fourth, and fifth messages are to be captured and displayed on the Stack page. Use BC pages 01-05 and RT pages 01-04 (RT addresses are 12, 04, 08, and 09 respectively). The Terminal page shall appear as in Figure 3, and the Stack page shall appear as in Figure 4. The first message shall contain a NO RESPONSE error, the second message shall contain the same error as Task 2, and the mode command shall be the Transmit Vector Word command (as shown in Figure 3). Make all messages appear on the primary bus, except the fifth message, which shall appear on the secondary bus.

```
                                                          01:06:48
*TI                    *FULL                              HEX 1553
>  SAVE CRT TO LPT                                        PAGE 07
   TERM     SUB    WC     BUS CMDS   ERR%    ERRORS
   ********************************************* *********
   01     R 01     01     PRI 03581 035C :  NORESP*
   ********************************************** *
   04     T 01     04     PRI 03583 0356.:* *
   08     R 01     01     PRI 03585 00000* *
  R09     T 01     01     PRI 03587 00000* *
   12     T 00     10     SEC 03589 00000* *
                                          * *
                                          * *
                                          * *
                                          * *
                                          : *
                                          * *

   TOTAL ERRORS-          7,184
```

Figure 3. Terminal page

```
> SAVE CRT TO LPT

   ADDR BUS   ERRORS WN   STACK DATA

T     2 PRI           0   C01 R 01 01
      3 PRI  NORESP    1   D0000
      4                          1.212 USEC
      5 PRI           0   R09 T 01 01
      6 PRI           0   S09 0 00 00
      7 PRI           1   D0000
      8 PRI           0   S08 0 00 00
      9                          1.096 USEC
     10 SEC           0   C12 T 00 10
     11 SEC           0   S12 0 00 00
     12 SEC           1   D0000
     13                         7.712 USEC

   START
```

Figure 4. Stack page

SOLUTION TO TASK 3

This task requires five BCs and RTs along with the Frame Format and Capture pages to be set up. Perform the following for this task:

1. The BC 01 page contains the correct entries in the default state (Figure ii), except that we are not going to set up an SBA RT page to respond to this command (since the TASK calls for a NORESP error for this message), so we must set the SBA RESPONSE line to NO as shown in Figure 12.

2. Display and set BC 02 page. Enter DB02 to display this page. Perform the following to set up this page. See Figure 9.

   (A) On the CMD WORD line enter the command C04 T 01 04.

   (B) On the SBA RESPONSE line enter Y for YES.

3. Display and setup RT 02 page. Enter DR02 to display this page. Perform the following to set up this page. See Figure 10.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command from the BC 02 page, C04 T 01 04. (C04 T XX XX could also have been used).

   (C) On the STATUS WORD line enter the same terminal address as in the RESP CMD, (S04 0 00 00).

(D) On the ERROR line enter PR, which is the keystroke code for PARITY, ripple thru message. This will cause a parity error to appear in the RT response, rippling to the next successive word each time the RT responds.

4. Display and set up the BC 03 page. Enter DB03 to display this page. Perform the following to set up this page. See Figure 13.

   (A) On the CMD WORD line enter the command word C08 R 01 01.

   (B) On the SBA RESPONSE line enter Y for YES.

5. Display and set up the RT 03 page. Enter DR03 to display this page. Perform the following to set up this page. See Figure 14.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command word from the BC 03 page.
   C08 R 01 01

   (C) On the STATUS WORD line enter the same terminal address as in the RESP CMD.
   (S08 0 00 00).

6. Display and set up the BC 04 page. Enter DB04 to display this page. Perform the following to set up this page. See Figure 15.

   (A) On the CMD WORD line enter C09 T 01 01.

   (B) On the SBA RESPONSE line enter Y for YES.

7. Display and set up the RT 04 page. Enter DR04 to display this page. Perform the following to set up this page. See Figure 16.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command word from the BC 04 page
   C09 T 01 01.

   (C) On the STATUS WORD line enter the same terminal address as RESP CMD
   (S09 0 00 00).

8. Display and set up the BC 05 page. Enter DB05 to display page. Perform the following to set up this page. See Figure 17.

   (A) On the CMD WORD enter the command C12 T 00 10 (the 1553 mode command for "Transmit Vector Word").

   (B) On the BUS SELECT line enter S for SEC (secondary bus).

   (C) On the SBA RESPONSE line enter Y for YES.

9. Display and set up RT 01 page. Enter DR01 to display this page. Perform the following to set up this page. See Figure 18.

   (A) On the ENAB line enter Y for YES.

   (B) On the RESP CMD line enter the command word from the BC 05 page C12 T 00 10.

   (C) On the STATUS WORD line enter the same terminal address as in the RESP CMD (S12 0 00 00).

   (D) On the ERROR line enter W -15 for WRDCNT -15. This is necessary so the right amount of data words will be transmitted according to the mode command to which this RT page is to respond. (The command has 10 HEX [16 DEC] in the mode code/word count field, so this RT page would ordinarily respond with a status word and 16 data words. But since this is a Transmit Vector Word mode command, only one data word should appear in the response. The WRDCNT-15 entry on the ERROR line suppresses the extra 15 data words).

10. Display and set up the Capture page. Enter DC to display this page. Perform the following to set up this page. See Figure 19.

    (A) On the T1 line enter C01 R 01 01 in the VALUE column. This will make the SBA's stack 'trigger' on the first command in the series we wish to capture.

    (B) On the CAPT MODE line enter O for ONLY.

    (C) On the M1 line, enter Y for YES in the ENA column, and C01 R 01 01 in the VALUE column.

    (D) On the M2 line, enter Y for YES in the ENA column, and C08 R 01 01 in the VALUE column.

    (E) On the M3 line, enter Y for YES in the ENA column, and C12 T 00 10 in the VALUE column.

11. Display and set up the Frame Format page. Enter DF to display this page. Perform the following to set up this page. See Figure 20.

    (A) Enter CF001 for CHANGE FRAME 001. The SBA displays the symbol //, indicating that this symbol is in slot 001. Enter 02 to insert BC message 02 at this point in the transmit sequence. DO NOT ENTER CARRIAGE RETURN.

    (B) Press the INCR key and 02 will appear in the sequence in slot 001. The command line now displays the value for slot 002 (//). Enter 03 to insert BC message 03 into the transmit sequence.

    (C) Press the INCR key again and enter a dash (-). The SBA will show a double dash (--). This symbol indicates that two command words will be joined to make a RT-to-RT transfer command pair. The CRT message line will display an Illegal Entry statement, but ignore this for now.

(D) Press the INCR key again and enter 04. The illegal statement will disappear.

(E) Press the INCR key once more and enter 05. Enter carriage return to complete the entry of this new sequence of BC pages to be transmitted.

12. Enter XF for XMIT FOREVER. Then enter DT to display the Terminal page, which will appear as shown in Figure 3.

13. Enter R for RUN STACK followed by DS1 to display the Stack page starting at stack address 1. The Stack page will appear as shown in Figure 4, except that time values (displayed in microseconds) may vary somewhat.

No Changes Made

```
SAVE CRT TO LPT                                  HEX 1552
                                                 PAGE 00

OPERATIONAL MODE:
 NORESP (A=10,B=12,C=5,D=17,E=50)U----B
 BROADCAST COMMANDS ---- ---------------NO
 BUS SELECT-------- ---------------------INT
 OUTPUT AMPLITUDE(COUNT)---------- ------128
 XMIT FREQ---------------------------------NOR
 ZERO XING DEVIATION(NSEC)-----------------A,+150

FUNCTION DEFINITION:
 FUNCTION---- -- -- ------ ---- ----RAND
 UPPER LIMIT -- -- ---------- ----0000
 LOWER LIMIT---------- ---- ----0000
 CYCLE---- ---------- ---- ----001
 STEP---- ---- ------ ------ ----001
```

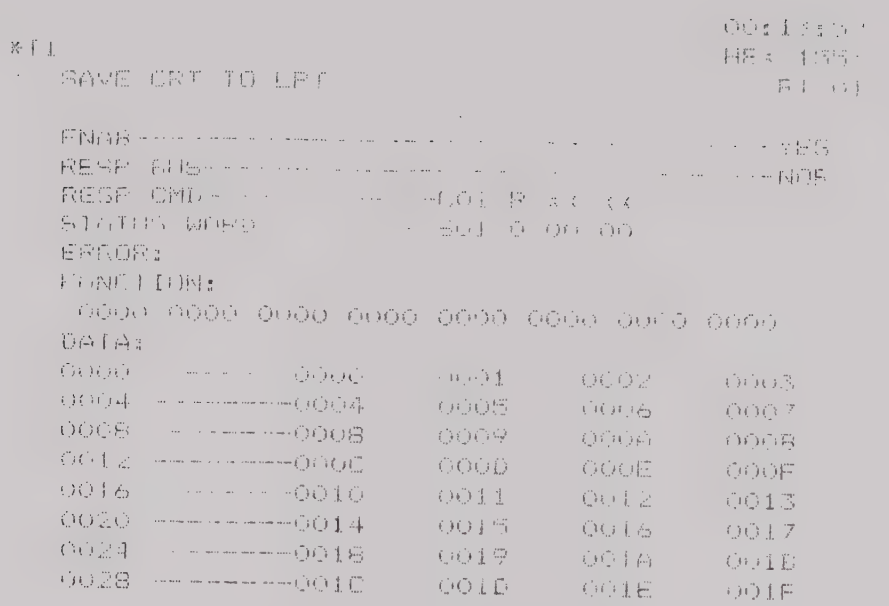
Figure i. Operation Mode 01

```
                                                 00:13:42
*TI                                              HEX 1552
SAVE CRT TO LPT                                  PAGE 01

RESERVED STATUS BIT---1111111111

T/R MODE RSVD*T/R MODE RSVD*T/R MODE RSVD*
**********************************************
  1 00000 NO   *  1 00001 NO   *  1 00010 NO
  1 00011 NO   *  1 00100 NO   *  1 00101 NO
  1 00110 NO   *  1 00111 NO   *  1 01000 NO
  1 01001 YES  *  1 01010 YES  *  1 01011 YES
  1 01100 YES  *  1 01101 YES  *  1 01110 YES
  1 01111 YES  *  1 10000 NO   *  0 10001 NO
  1 10010 NO   *  1 10011 NO   *  0 10100 NO
  0 10101 NO   *  1 10110 YES  *  1 10111 YES
  1 11000 YES  *  1 11001 YES  *  1 11010 YES
  1 11011 YES  *  1 11100 YES  *  1 11101 YES
  1 11110 YES  *  1 11111 YES  *
```

Figure ii. Operation Mode 02

```
                                                 00:15:20
*I                                               HEX 1552
SAVE CRT TO LPT                                  BC 01

CMD WORD----------C01 R 01 01
SAP TIME---------- ---- 0010 USEC
BUS SELECT---------- ------ ---------PRI
SUB RESPONSE------ ---- ------ ------ ----
ERROR:
FUNCTION:
 0000 0000 0000 0000 0000 0000 0000 0000
DATA:
0000 ----------0000   0001   0002   0003
0004 ----------0004   0005   0006   0007
0008 ----------0008   0009   000A   000B
000C ----------000C   000D   000E   000F
0010 ----------0010   0011   0012   0013
0014 ----------0014   0015   0016   0017
0018 ----------0018   0019   001A   001B
001C ----------001C   001D   001E   001F
```

Figure iii. BC 01 Page



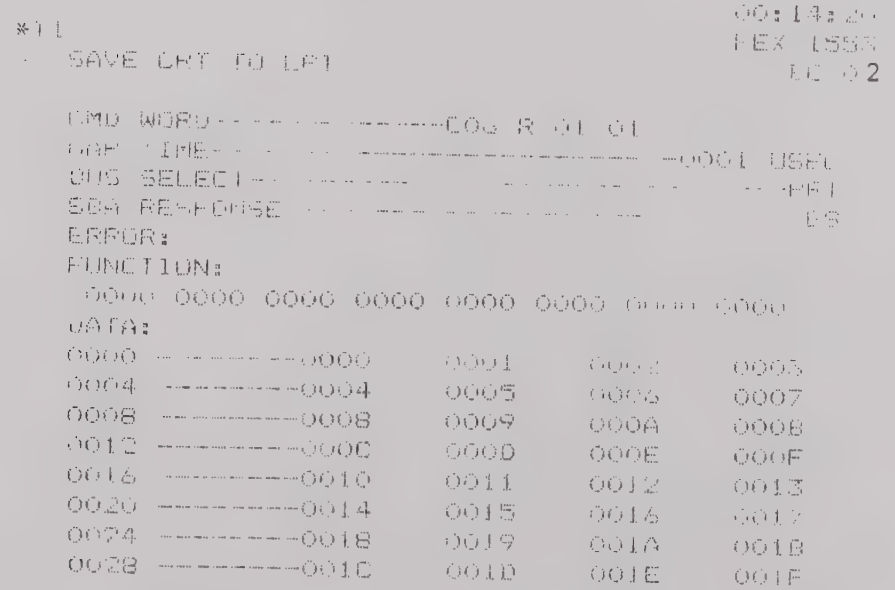
```
*T1                                                    00:15:0
                                                       HR: 1??
   SAVE CRT TO LP1                                        01

   ENAB-------------------------------------------------YES
   RESP BIT---------------------------------------------NO
   RESP CMD-------------------(01) R 01 01
   STATUS WORD-----------------(01) 0 00 00
   ERROR:
   FUNCTION:
    0000 0000 0000 0000 0000 0000 0000 0000
   DATA:
   0000 ---------0000 0001 0002 0003
   0004 ---------0004 0005 0006 0007
   0008 ---------0008 0009 000A 000B
   000C ---------000C 000D 000E 000F
   0010 ---------0010 0011 0012 0013
   0014 ---------0014 0015 0016 0017
   0018 ---------0018 0019 001A 001B
   001C ---------001C 001D 001E 001F
```

-- The RT was enabled.

-- The Response Command was entered.

-- The Status Word was entered.

Figure 5. RT 01 page



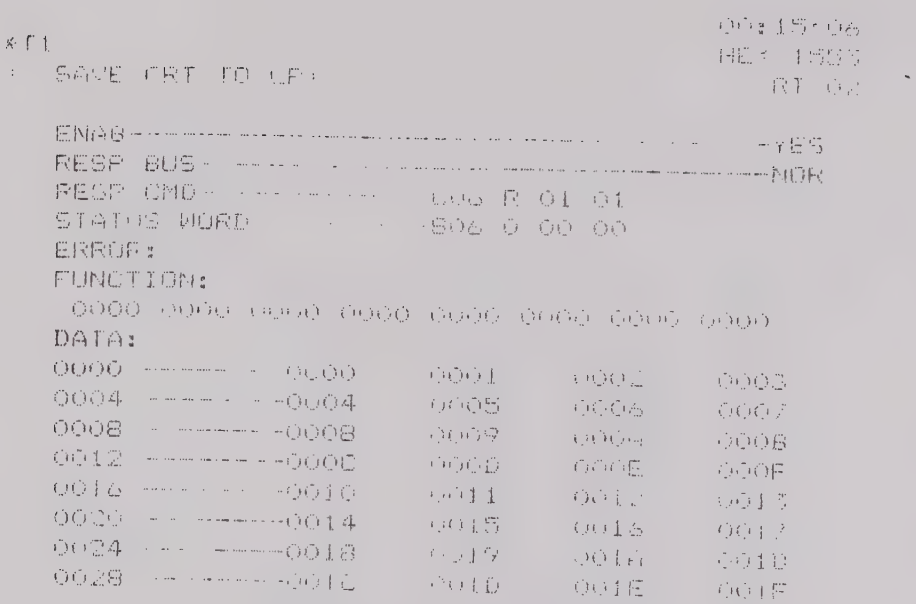
```
*T1                                                    00:14:2?
   SAVE CRT TO LP1                                     HEX 1553
                                                          BC 02

   CMD WORD---------------(02) R 01 01
   GAP TIME---------------------------------0001 USEC
   BUS SELECT-------------------------------------HI
   SBA RESPONSE-----------------------------------YES
   ERROR:
   FUNCTION:
    0000 0000 0000 0000 0000 0000 0000 0000
   DATA:
   0000 ---------0000 0001 0002 0003
   0004 ---------0004 0005 0006 0007
   0008 ---------0008 0009 000A 000B
   000C ---------000C 000D 000E 000F
   0010 ---------0010 0011 0012 0013
   0014 ---------0014 0015 0016 0017
   0018 ---------0018 0019 001A 001B
   001C ---------001C 001D 001E 001F
```

-- The command word was entered.

-- "SBA RESPONSE" was changed to "YES".

Figure 6. BC 02 page

Changes Made



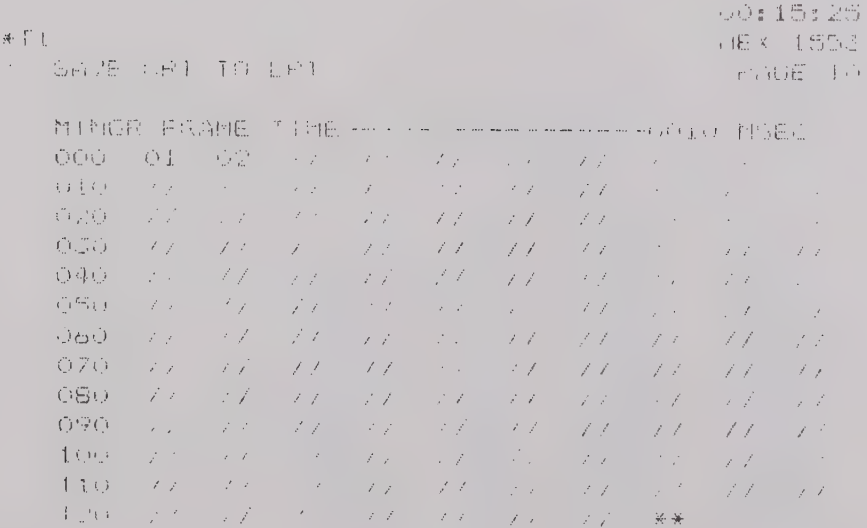
-- The RT was enabled.

-- The RESP CMD was entered (C06 R01 01).

-- The STATUS WORD was entered (S06 0 00 00)

Figure 7. RT 02 page

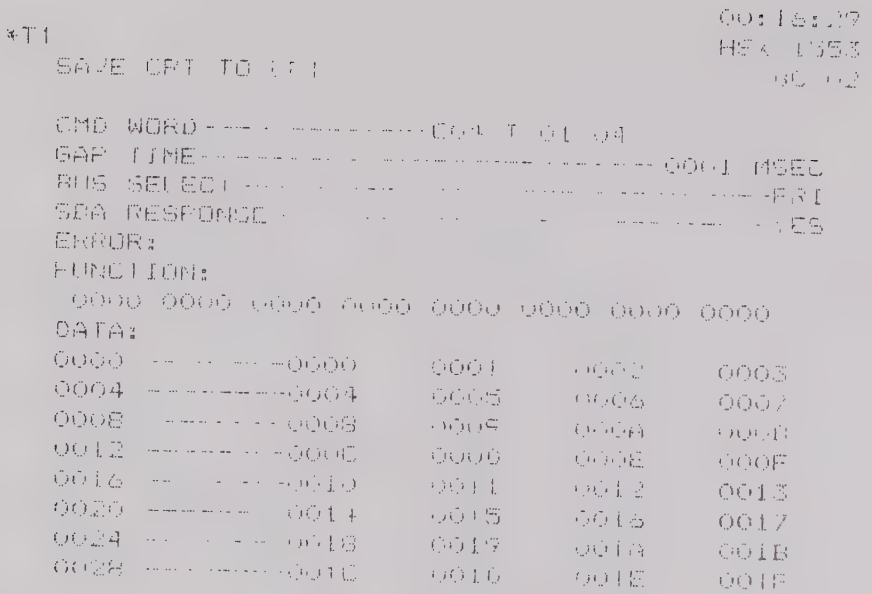
Changes Made



-- BC message 02 was added to the transmit sequence.

Figure 8. Frame Format page

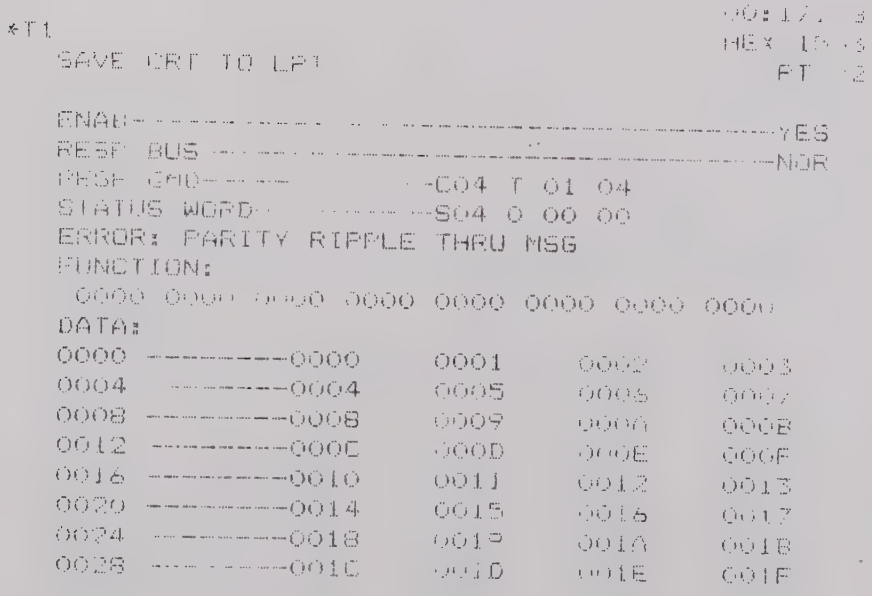
Changes Made



-- The CMD WORD was entered (C04 T 01 04
-- SBA RESPONSE was changed to YES.

Figure 9. BC 02 page

Changes Made



-- The RT was enabled.
-- The RESP CMD was entered (C04 T 01 04)
-- The STATUS WORD was entered (S04 0 00 00)
-- A PARITY error was entered.

Figure 10. RT 02 page

Changes Made

```
*T1                                                    00:22:25
                                                       HEX 1553
   SAVE CRT TO LPT                                      PAGE 02

   TRIG MODE=START
   TRIG LINK=T1 OR  T2 OR  T3 OR  T4

   TRIG ENA BUS  ERROR    VALUE
   T1   YES BTH =         =C04 T 01 04
   T2   NO  BTH =         =CXX X XX XX
   T3   NO  BTH =         =CXX X XX XX
   T4   NO  BTH =         =CXX X XX XX

   CAPT MODE=ONLY

   MESG ENA BUS  ERROR    VALUE
   M1   YES BTH =         =C04 T 01 04
   M2   NO  BTH =         =CXX X XX XX
   M3   NO  BTH =         =CXX X XX XX
   M4   NO  BTH =         =CXX X XX XX
```

-- The T1 VALUE was entered (C04 T 01 04)

-- The CAPT MODE was changed to ONLY.

-- Message line M1 was enabled (YES was entered). The M1 VALUE was entered (C04 T 01 04).

Figure 11. Capture Page

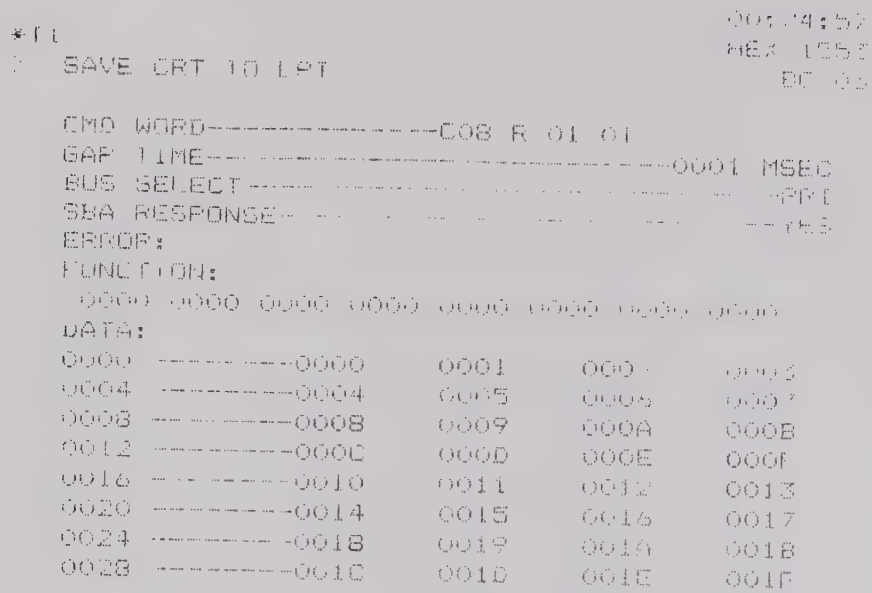
Changes Made

```
*T1                                                    00:23:57
                                                       HEX 1553
   SAVE CRT TO LPT                                      BC 01

   CMD WORD--------------C01 R 01 01
   GAP TIME--------------0001 USEC
   BUS SELECT------------PRI
   SBA RESPONSE----------NO
   ERROR:
   FUNCTION:
    0000 0000 0000 0000 0000 0000 0000 0000
   DATA:
   0000 ---------0000    0001    0002    0003
   0004 ---------0004    0005    0006    0007
   0008 ---------0008    0009    000A    000B
   0012 ---------000C    000D    000E    000F
   0016 ---------0010    0011    0012    0013
   0020 ---------0014    0015    0016    0017
   0024 ---------0018    0019    001A    001B
   0028 ---------001C    001D    001E    001F
```

-- SBA RESPONSE was changed to NO.

Figure 12. BC 01 page

Changes Made

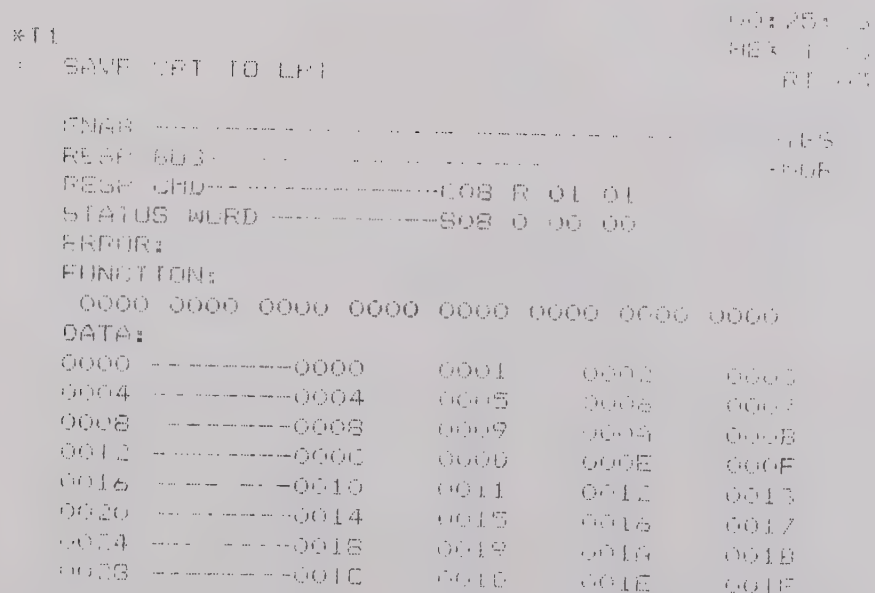


-- The CMD WORD was entered (C08 R 01 0

-- SBA RESPONSE was changed to YES.

Figure 13. BC 03 page

Changes Made



-- The RT was enabled.

-- The RESP CMD was entered (C08 R 01 01

-- The STATUS WORD was entered (S08 0 00 0C

Figure 14. RT 03 page

Changes Made

```
*T(                                                    00:??:??
                                                       HEX 1553
>  SAVE CRT TO LPT                                        BC 04

    CMD WORD----------------C09 T 01 01
    BAP TIME----------------------------0001 MSEC
    BUS SELECT--------------------------PRI
    SBA RESPONSE------------------------YES
    ERROR:
    FUNCTION:
     0000 0000 0000 0000 0000 0000 0000 0000
    DATA:
    0000 ---------0000     0001     0002     0003
    0004 ---------0004     0005     0006     0007
    0008 ---------0008     0009     000A     000B
    0012 ---------000C     000D     000E     000F
    0016 ---------0010     0011     0012     0013
    0020 ---------0014     0015     0016     0017
    0024 ---------0018     0019     001A     001B
    0028 ---------001C     001D     001E     001F
```

-- The CMD WORD was entered (C09 T 01 01).

-- SBA RESPONSE was changed to YES.

Figure 15. BC 04 page

Changes Made

```
*T(                                                    00:??:??
                                                       HEX 1553
>  SAVE CRT TO LPT                                        RT 04

    ENAB--------------------------------------YES
    RESP BUS----------------------------------NOR
    RESP CMD----------------C09 T 01 01
    STATUS WORD-------------S09 0 00 00
    ERROR:
    FUNCTION:
     0000 0000 0000 0000 0000 0000 0000 0000
    DATA:
    0000 ---------0000     0001     0002     0003
    0004 ---------0004     0005     0006     0007
    0008 ---------0008     0009     000A     000B
    0012 ---------000C     000D     000E     000F
    0016 ---------0010     0011     0012     0013
    0020 ---------0014     0015     0016     0017
    0024 ---------0018     0019     001A     001B
    0028 ---------001C     001D     001E     001F
```

-- The ENAB was changed to YES.

-- The RESP CMD was entered (C09 T 01 01).

-- The STATUS WORD was entered (S09 0 00 00).

Figure 16. RT 04 page

Changes Made

```
                                                        00:27:36
*F1                                                     HEX 1553
    SAVE CRT TO LPT                                        BC 05

    CMD WORD----------------C12 T 00 10
    GAP TIME----------------------------------0001 MSEC
    BUS SELECT--------------------------------SEC
    SBA RESPONSE------------------------------YES
    ERROR:
    FUNCTION:
     0000 0000 0000 0000 0000 0000 0000 0000
    DATA:
    0000 ---------0000      0001      0002      0003
    0004 ---------0004      0005      0006      0007
    0008 ---------0008      0009      000A      000B
    0012 ---------000C      000D      000E      000F
    0016 ---------0010      0011      0012      0013
    0020 ---------0014      0015      0016      0017
    0024 ---------0018      0019      001A      0018
    0028 ---------001C      001D      001E      001F
```

-- The CMD WORD was entere (C12 T 00 01).

-- BUS SELECT was changed to SEC.

-- SBA RESPONSE was change to YES.

Figure 17. BC 05 page

Changes Made

```
                                                        00:28:02
*F1                                                     HEX 1553
    SAVE CRT TO LPT                                        RT 01

    ENAB--------------------------------------------------YES
    RESP BUS----------------------------------------------NOR
    RESP CMD----------C12 T 00 10
    STATUS WORD-------S12 0 00 00
    ERROR: WRDCNT -15
    FUNCTION:
     0000 0000 0000 0000 0000 0000 0000 0000
    DATA:
    0000 ---------0000      0001      0002      0003
    0004 ---------0004      0005      0006      0007
    0008 ---------0008      0009      000A      000B
    0012 ---------000C      000D      000E      000F
    0016 ---------0010      0011      0012      0013
    0020 ---------0014      0015      0016      0017
    0024 ---------0018      0019      001A      0018
    0028 ---------001C      001D      001E      001F
```

-- The RT was enabled.

-- The RESP CMD was entere (C12 T 00 10).

-- The STATUS WORD was entered (S12 0 00 00).

-- A Word Count error was entered (WRDCNT -15) to suppress extra data data words that would otherwise be transmitte

Figure 18. RT 01 page

Changes Made

```
                                                    00:31:49
<T1                                                 HEX 1553
: SAVE CRT TO LPT                                    PAGE 02

   TRIG MODE=START
   TRIG LINK=T1 OR  T2 OR  T3 OR  T4

   TRIG ENA BUS  ERROR    VALUE
   T1   YES BTH =         =C01 R 01 01
   T2   NO  BTH =         =CXX X XX XX
   T3   NO  BTH =         =CXX X XX XX
   T4   NO  BTH =         =CXX X XX XX

   CAPT MODE=ONLY

   MESG ENA BUS  ERROR    VALUE
   M1   YES BTH =         =C01 R 01 01
   M2   YES BTH =         =R09 T 01 01
   M3   YES BTH =         =C12 T 00 10
   M4   NO  BTH =         =CXX X XX XX
```

-- The T1 VALUE was entere (C01 R 01 01).

-- The T2 was enabled and value entered.

-- The T3 was enabled and value entered.

-- The CAPT MODE was chang to ONLY.

-- The M1 was enabled and value entered.

-- The M2 was enabled and value entered.

-- The M3 was enabled and value entered.

Figure 19. Capture page

Changes Made

```
                                                    00:32:26
<T1                                                 HEX 1553
: SAVE CRT TO LPT                                    PAGE 03

   MINOR FRAME TIME----------------------0010 MSEC
   000  01  02  03  --  04  05  //  //  /.  //
   010  //  //  //  //  //  //  //  //  //  //
   020  //  //  //  //  //  //  //  //  //  //
   030  //  //  //  //  //  //  //  //  //  //
   040  //  //  //  //  //  //  //  //  //  //
   050  //  //  //  //  //  //  //  //  //  //
   060  //  //  //  //  //  //  //  //  //  //
   070  //  //  //  //  //  //  //  //  //  //
   080  //  //  //  //  //  //  //  //  //  //
   090  //  //  //  //  //  //  //  //  //  //
   100  //  //  //  //  //  //  //  //  //  //
   110  //  //  //  //  //  //  //  //  //  //
   120  .   //  //  .   //  //  //  **
```

-- The BC message 02, 03, 0 and 05 was added to the transmit sequence. The RT-RT transfer symbol separates 03 and 04.

Figure 20. Frame Format page

THEORY OF OPERATION

INTRODUCTION

This section presents a comprehensive description of the primary operational modes of the SBA 100, followed by the theory of operation for each major component of the system. The section concludes with a description of system software.

PURPOSE

The SBA 100 is an automatic troubleshooting, network analysis, and simulation test device designed to exercise an internal time-division command/response multiplex data bus to the limits of MIL-STD-1553 A and B. The unit can be operated within the data bus under normal or abnormal operations, introducing up to 14 error types into the system to validate system integrity and reliability.

CAPABILITY

Automatic test capabilities allow operation of the SBA 100 as a bus controller tester or a remote terminal tester. It may also be used in a passive capacity, monitoring and recording both transmit and receive data. This data can be stored and recalled at the user's discretion. The user has the option of storing the information on magnetic tape for future reference or recalling it from the stack memory. If a specific message is to be captured, a specific event trigger can be selected and the system memory captures up to 2048 data bus words in any combination of transmit or receive. The SBA 100 also has a separate 698 word transmit buffer plus a 256 word function buffer which can generate messages in the active mode as a Bus Controller (BC) or Remote Terminal (RT).

CAPABILITY (Contd)

Further enhancing the flexibility and utility of the SBA 100 is the user interface designed to provide maximum machine capability with minimum operator effort. This is accomplished by providing a keyboard-controlled menu selection of all format, monitor and simulation modes. The menu guides the operator through the operating choices so that the variables for each choice need not be remembered. Initial settings can be recalled for review or alteration at any time using the detachable full-ASCII keyboard or the front-panel keypad independently. Using this scheme, the entire system can be quickly and easily programmed.

OPERATIONAL MODES

The SBA 100 provides two main modes of operation: passive and active. The passive mode, which is the default condition, is further divided into two categories: the background activity monitor and the selective activity monitor. The passive mode, which is in operation at all times, provides the data bus activity monitoring function of the SBA 100. The active mode is further divided into the categories of remote terminal (RT) tester and bus controller (BC) tester. The RT and BC modes may be in operation independently or simultaneously. The active mode provides the function of stimulating the MIL-STD-1553 data bus and can be initiated only by the operator.

The following is a summary of the SBA 100 operational modes:

OPERATIONAL MODES (Contd)

1. Passive Mode:
   a. Background Activity Monitor.
   b. Selective Activity Monitor.
2. a. Remote Terminal Tester Mode
      (1) Normal RT Stimulation.
      (2) Abnormal RT Stimulation.
   b. Bus Controller Tester Mode
      (1) Normal BC Stimulation.
      (2) Abnormal BC Stimulation.
   c. Automatic Noise Test Mode

Passive Mode

The passive mode, illustrated in Figure 3-1, is divided into two categories, the background activity monitor and the selective activity monitor.

Background Activity Monitor Mode

The background activity monitor mode operates at all times to provide a synopsis of data bus activity to the operator. This mode provides the following functions:

1. Monitors and maintains statistics on all bus traffic on a message basis by commands, and displays this information in ascending order by terminal address, transmit/receive bit, subaddress and word count.
2. Identifies all mode code commands to each active terminal by subaddress/mode code control value (11111 or 00000) and actual mode code number.
3. Monitors all error elements logging each error type and maintaining a running total count of all error elements. Any of the following error conditions will be stored in the background activity processor.

Background Activity Monitor Mode (Contd)

a. Encoding Error - This includes invalid biphase encoding of information and parity bits.

b. Improper Sync - The transmission of a command sync in place of a data sync or vice versa.

c. Improper parity.

d. High word count.

e. Low word count.

f. High bit count in a word.

g. Low bit count in a word.

h. No response by a terminal to a valid command.

i. Premature response time of a terminal.

j. Discontiguous command and data words, status and data words, or between data words of greater than 0.5 microseconds.

k. Message error bit set.

l. Reserved bits in status word set as defined by the operator.

m. Simultaneous transmission of commands on each of the data busses and any overlap of valid commands.

n. Terminal address error (RT status address not equal to command terminal address).

o. Transmission of a mode command with improper transmit/receive bit value, or a reserved mode code value.

p. Operator-defined reserved mode codes and status word bits as defined by the operator.

Background Activity Monitor Mode (Contd)

4. Monitors all preceding information to the SBA 100 in real-time while dynamically displaying all of the information.

5. All messages are identified with the number of occurences per message, the bus on which they occured, the number of errors, and the type of error.

Selective Activity Monitor Mode

The selective activity monitor mode is selected by the operator to function concurrently with the background monitor mode. In this mode the SBA 100 monitors the dual-redundant data busses to detect a trigger event which is defined by the operator and may be any of a number of conditions (see Capture Page programming, Section 4.4.7). Upon detecting a trigger condition, the SBA 100 functions like a logic analyzer and captures up to 2048 command, data, time tag and status words for display. Bus traffic can be captured preceding, centered about, or subsequent to the trigger conditions for display and recording. Time intervals between commands are indicated. The operator can enable or disable any or all of the error trigger elements listed in paragraph 3.3.1.1. Provision is also made to use any of the monitor-captured data words for retransmission in the remote terminal tester or bus controller tester function without manual re-entry of the data into the system (see MOVE STACK command).

Any of the following monitor event trigger elements cause an event trigger to occur when selected by the operator:

1. Any command transmitted over the data busses identified by the background activity monitor function.
2. A specific command word transmitted over the data busses which was previously identified by the operator on the basis of terminal address, transmit/receive bit, subaddress, data word count, active bus, or any combination of these fields.
3. A specific status word transmitted over the data busses which is identified by the operator on the basis of terminal address, a specific bit pattern of logic ones,

logic zeros, and don't cares in the eleven least significant bits of the status words, active bus, or any combination of these fields.

4. A specific data word transmitted over the data bus.
5. A specific second command of an RT to RT transfer.
6. Any 16-bit value transmitted over the data busses.
7. Any of the error types listed in 3.3.1.1. Individual errors or no errors may be specified.
8. An exclusionary function on error types and data may be specified.
9. Don't Cares (X's) may be specified for any combination of bits in the data field.

The operator can also select what data is to be captured on the occurrence of the trigger conditions specified above. All bus traffic, or up to 4 different capture options may be specified by the command word, status word, new command, data word, second word of RT to RT command, or any 16-bit value. Each trigger or capture may be added with any of the error conditions specified in paragraph 3.3.1.1.

Active Mode

The active mode is illustrated in Figure 3-2. This mode provides normal and abnormal stimulation of the MIL-STD-1553 bus. The active mode includes the remote terminal (RT) tester mode and the bus controller (BC) mode.

RT Tester Mode

The remote terminal tester mode is activated by operator-command while still performing the monitor functions. In conducting the RT mode tests, the SBA 100 acts as a bus controller and issues commands to an RT to verify RT compliance with MIL-STD-1553 A or B. Automatic and manual RT tester modes are provided.

Manual RT Tester Mode The Manual RT tester mode is used to test one or more RT's over either of the busses. The operator can define a minimum of 32 independent messages for a maximum of 700 command and data words. The operator also has the option of selecting random data patterns for the data words and can

- RT Tester Mode (Contd)

cause the SBA 100 to generate any one of the abnormal transmissions listed below in each message transmitted independent of other message errors programmed.

The SBA 100 will automatically perform the noise rejection tests outlined in MIL-STD-1553B. The noise rejection tests are initiated by the operator during the manual mode. The SBA 100 acts as the BC, as well as the monitor to count errors from the RT. Errors are defined as no responses or responses with the message error bit set. The number of errors along with the number of transmission words are tallied to determine if the RT under test has passed or failed the test. The pass/fail criteria meets applicable MIL-STD-1553B requirements. The results are displayed on the NOISE TEST page.

The SBA 100 can gate a noise source ON during its transmission and OFF during RT transmission by use of a noise gate output. The noise gate is generated for one operator-selectable message. The leading edge of the noise gate occurs 10 microseconds prior to the bus transmission. The trailing edge is operator-adjustable from 1.0 to 10.0 microseconds in one-microsecond steps after completion of the bus transmission. No other abnormal errors can be generated and no other tests are operating during the noise rejection tests.

Bus Controller Tester Mode The bus controller tester mode is activated by operator command while still performing the monitor function. In conducting the BC tests, the SBA 100 acts as remote terminals (RT's) and responds to BC commands to verify BC compliance with MIL-STD-1553 A or B, as appropriate. The operator can define 32 independent messages for one or more bus addresses and can

also generate any one of the abnormal transmissions, one at a time, in any of the independent messages. The SBA 100 monitors, and notes for display/recording, the BC responses to such abnormal transmissions.

Normal Bus Operation Test Mode The normal bus operation test mode stimulates the bus within the limits of MIL-STD-1553A/B as an RT during the bus controller test mode, or as a BC/RT during the remote terminal tester mode. Specifically, the following capabilities are provided:

1. Interrogates the RT to determine the RT bus address and to verify that it responds only to its legal address.
2. Verifies the RT proper response to the normal, broadcast, and mode code message formats defined in MIL-STD-1553 A or B as selected by the operator.
3. Tests the RT for all operator-defined message input combinations of transmit/receive, subaddress and word count and notes for display/recording the RT response.
4. Tests the RT for all operator-defined mode codes (valid or reserved), if applicable, and notes for display/recording the RT response.
5. Monitors for display/recording the RT response to broadcast commands as defined in MIL-STD-1553B.
6. Stimulates each one of the RT bus interfaces with the above tests.
7. Verifies the proper dual stand-by bus operation as defined in MIL-STD-1553B.
8. Verifies remote terminal-to-remote terminal (RT-to-RT) data transfer tests.
9. Operates as a BC and RT during RT-to-RT data transfer tests.

Abnormal Bus Operation Test Mode The abnormal bus operation test phase transmits deliberately faulty command and data words to the RT/BC to verify proper BC/RT response. For each abnormal condition, the SBA 100 provides operator-programmable alterations. The SBA 100 generates the following abnormal

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